

TECHNICAL MANUAL
FOR
EDRO
DYNAWASH[®]
WASHER-EXTRACTORS
150 and 200 LB. CAPACITY



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15 JAN 2001

CHAPTER 1

GENERAL INFORMATION AND SAFETY PRECAUTIONS

1-1 SAFETY PRECAUTIONS

1-1.1 General Safety Notices: The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein. If situations arise that are not covered in the general or specific safety precautions, the Commanding Officer or other authority will issue orders as deemed necessary to cover the situation.

Do Not Repair or Adjust Alone

Under no circumstances should repair or adjustments of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power is removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

Test Equipment

Make certain test equipment is in good condition. If a test meter must be held, ground the case of the meter before starting measurement; do not touch live equipment or personnel working on live equipment while holding a test meter. Some types of measuring devices should not be grounded; such devices should not be held when taking measurements.

Interlocks

Interlocks are provided for safety of personnel and equipment and should be used only for the purpose intended. They should not be battle-shortened or otherwise modified except by authorized maintenance personnel. Do not depend solely on interlocks for protection. Whenever possible, disconnect power at power distribution source.

Moving and Operating Equipment

Personnel shall remain clear of moving and/or operating equipment. If equipment requires adjustment while in operation, such as bearing lubrication, a safety watch shall be posted. The safety watch shall have a full view of operations being performed, and immediate access to controls capable of stopping equipment motion.

First Aid

An injury, no matter how slight, shall never go unattended. Always obtain first aid or medical attention immediately.

Resuscitation

Personnel working with or near high voltage shall be familiar with approved methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery. If someone is injured and stops breathing, initiate resuscitation immediately and notify medical personnel as soon as possible. A delay could cost the victim his life.

General Precautions

The following general precautions are to be observed at all times:

- a) The washer-extractor shall be installed in accordance with guidance and instructions contained in this technical manual and all applicable shipboard specifications and procedures.
- b) Install and ground all electrical components associated with the system/equipment in accordance with applicable Navy regulations and approved shipboard practices.
- c) Ensure that all maintenance operations comply with Navy Safety Precautions, OPNAVINST 5100 series.
- d) Observe precautions set forth in Naval Ships' Technical Manual (NSTM) chapters 300, 302, 310, and 320 with respect to electrical equipment and circuits.
- e) Ensure that protective guards and shutdown devices are properly installed and maintained around rotating parts of machinery and high voltage sources. Do not operate equipment without all safety guards, enclosures and devices in place.
- f) Do not wear loose clothing while working around rotating parts of machinery.
- g) Do not attempt to reach around, over or under any safety guard without first disconnecting electrical power and tagging "Out-of-Service".
- h) Ensure proper tag out procedures are followed and precautionary measures are employed to prevent applying power to the system/equipment any time maintenance work is in progress.
- i) Do not make any unauthorized alterations to equipment or components.
- j) Before working on electrical system/equipment, perform a voltmeter check to ensure that the system is not energized.
- k) Consider all circuits, not known to be "dead", "live" and dangerous at all times.
- l) When working near electricity, do not use metal rulers, flashlights, metallic pencils or any other objects having exposed conducting material.
- m) De-energize all equipment before connecting or disconnecting meters or test leads.
- n) When connecting a meter to terminals for measurements, use a range higher than expected voltage.
- o) Before operating equipment or performing any tests or measurements, ensure that all frames of motors and starter panels are securely grounded.
- p) Ensure that area is well ventilated when using cleaning solvents. Avoid prolonged breathing of fumes and solvent contact with eyes or skin.
- q) Never operate washer-extractor if JOG function is not functioning properly (i.e. JOG operation MUST require the use of both hands).
- r) Never operate machine if door pin does not engage during extract mode and/or releases prior to cylinder coming to rest following extract.
- s) Never operate machine if door switch does not disable machine operation (except JOG) while main door is opened.
- t) Never JOG cylinder without inner pocket doors securely closed.

- u) Always use appropriate personnel protective equipment (gloves, face shield and apron) while handling laundry and chemicals.

1-1.2 Safety Precautions Definitions. Warnings, cautions and notes appear throughout this technical manual. The warnings, cautions and notes appear following the paragraph heading and immediately preceding the text to which they apply. The following three examples define warnings, cautions, and notes as they are used in this manual. These definitions are followed by information that signals potentially dangerous conditions for the operator or equipment. Read this manual carefully and know when these conditions can exist. Take the necessary steps to train operating and maintenance personnel.

WARNING

Identifies an operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed could result in injury to or death to personnel.

CAUTION

Identifies an operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed could result in damage to or destruction of equipment or loss of mission effectiveness.

NOTE

Identifies an essential operating or maintenance procedure, precondition or statement which are essential but not of a known hazardous nature as indicated by warnings and cautions.

1-2 INTRODUCTION

1-2.1 Purpose. This manual contains descriptive technical information pertaining to installation procedures, set-up and test procedures, operational, maintenance and troubleshooting guidance and illustrated parts list for The EDRO Corporation DynaWash® washer-extractors models: DW1500HNSWE -13A and DW2000MNSWE -13A.

The information is presented as follows:

- CHAPTER 1 GENERAL INFORMATION AND SAFETY PRECAUTIONS
- CHAPTER 2 SHIPBOARD INSTALLATION
- CHAPTER 3 SET-UP AND OPERATIONAL TEST
- CHAPTER 4 OPERATING INSTRUCTIONS
- CHAPTER 5 MAINTENANCE INSTRUCTIONS
- CHAPTER 6 TROUBLESHOOTING GUIDANCE
- CHAPTER 7 ILLUSTRATIONS AND PARTS LIST

1-2.2 Scope. This manual was developed in accordance with applicable technical manual requirements. Detailed physical and functional descriptions of each washer-extractor are provided. Sufficient information is provided herein to enable personnel to install, test, operate, maintain, troubleshoot, and repair the equipment.

1-2.3 Reporting Errors, Omissions and Discrepancies. This manual supersedes S6162-AC-MMC-010 dated 1 May 1980 and all changes thereto for The EDRO Corporation 150 and 200 pound shipboard washer-extractors. It contains the information necessary to set-up, test, operate, troubleshoot, repair and maintain the washer-extractors on all classes of U.S. Naval Ships. Ship's training activities, supply points, depots, Naval Shipyards, and Supervisors of Shipbuilding are requested to arrange for the maximum practical use and evaluation of NAVSEA technical manuals. All errors, omissions, discrepancies, and suggestions for improvement to NAVSEA technical manuals shall be reported to the Commander, Port Hueneme Division, Naval Surface Warfare Center, Port Hueneme, CA 93043-4307 on NAVSEA Technical Manual Deficiency/Evaluation Report, NAVSEA Form 4160/1. To facilitate such reporting, two copies of NAVSEA Form 4160/1 are included at the end of each bound part of each technical manual. All feedback comments shall be thoroughly investigated and originators will be advised of action resulting therefrom. Extra copies of NAVSEA Form 4160/1 may be requisitioned from DDSP, 5450 Carlisle Pike, Bldg 05, Mechanicsburg, PA 17055-7089.

1-3 EQUIPMENT DESCRIPTION

1-3.1 Intended Use. The washer-extractor shall be installed in the ship's manned laundry for cleaning shipboard laundry only; civilian clothes shall not be processed in the ship's manned laundry. The washer-extractors shall be installed within a coaming area containing sufficient deck drains to drain off water spillage. The washer-extractor performs the following principle functions: water and chemical injection, wash/clean, rinse, drain, and water extraction. The washer-extractor is comprised of two basic parts: an outer shell or tub and a revolving cylinder within the tub. The shell holds the water and chemicals and the revolving cylinder holds the clothing. The cylinder is highly perforated with small holes on its outer surface. These small holes allow the chemicals and water to enter, saturate and pass through the clothing within the cylinder. The clothing is cleaned by chemical and mechanical action. The mechanical action is dependent on the number and height of the rises and falls of the clothing per unit of time within the cylinder. Chemical action is dependent on the correct amount of chemical product per unit volume of water. Too much chemical product per unit volume of water causes chemical particle entrapment within the garment fibers, which cause yellowing of the garment during drying and finishing. Too little chemical product per unit volume of water decreases chemical cleaning action. Extraction is performed after the tub has been drained to remove large amounts of water from the clothing. The extraction process is created by the acceleration of the cylinder from the slow rotation of washing to a much faster rotation. With the cylinder rotating at such a high rate of speed, the centrifugal force removes a majority of water from the clothing.

1-3.2 Functional Description. The washer-extractor is operated by a fully automatic programmable logic controller with the ability to control all operating aspects of the wash and extract cycles of the three preprogrammed standard Navy wash formulas, Table 1-1, and one short cycle 9 minute test formula, Table 1-2. The machines are equipped with a supplemental indirect steam booster heater capable of increasing the temperature of the bath water in the event the ship service hot water is inadequate. The cylinder is divided into three compartments each rated at 1/3 the total machine capacity. Multi-pocket machines provide greater operational

flexibility, allowing the SH to segregate multiple divisional loads into individual pockets which is not possible in open pocket machines.

1-4 REFERENCE DATA

1-4.1 Manufacturer's Identification Plate Data

Manufacturer: The EDRO Corporation
37 Commerce Street
P. O. Box 308
East Berlin, CT 06023-0308

Phone: 860-828-0311

Fax: 860-828-5984

Internet: <http://www.edrodynawash.com>

E-Mail: service@edrodynawash.com

FSCM: 01551

1-4.2 Technical Specifications. Tables 1-3 and 1-4 list the applicable technical specification for each model washer-extractor. Figures 1-1 and 1-2 provide a general view of the 150 and 200 pound machines.

TABLE 1-1
STANDARD NAVY WASH FORMULAS

FORMULA I - WHITE AND KHAKI COTTON, SYNTHETIC AND SYNTHETIC/COTTON BLEND FABRICS.

FORMULA II - UTILITY AND ORGANIZATIONAL CLOTHING.

<u>Step</u>	<u>Operation</u>	<u>Step Time</u>	<u>Descending Time</u>	<u>Water</u>	<u>Set Point/Temp. Setting</u>	<u>Water Level</u>	<u>Supplies</u>
1	Break/Suds	13	32	Hot	Set Pt. 2/130 °F	Low - 4"	Supply 1(*)
	Drain	1	19				
2	Flush/Suds	3	18	C. Temp	Set Pt. 1/130 °F	Low - 4"	
	Drain	1	15				
3	Extract (Low)1		14				
4	Rinse	3	13	C. Temp	Set Pt. 1/130 °F	Low - 4"	
	Drain	1	10				
5	Rinse	4	9	C. Temp	Set Pt. 1/130 °F	Low - 4"	Supply 2
	Drain	1	5				
6	Extract	4	4				

FORMULA III - WOOLENS, SYNTHETIC/WOOL BLEND FABRICS AND SPECIAL HAZARD UNIFORMS.

<u>Step</u>	<u>Operation</u>	<u>Step Time</u>	<u>Descending Time</u>	<u>Water</u>	<u>Set Point/Temp. Setting</u>	<u>Water Level</u>	<u>Supplies</u>
1	Break/Suds	13	32	Blend	Set Pt. 2/100 °F	High - 9"	Supply 1(*)
	Drain	1	19				
2	Flush/Suds	3	18	C. Temp	Set Pt. 1/90 °F	High - 9"	
	Drain	1	15				
3	Extract (Low)1		14				
4	Rinse	3	13	C. Temp	Set Pt. 1/90 °F	High - 9"	
	Drain	1	10				
5	Rinse	4	9	C. Temp	Set Pt. 1/90 °F	High - 9"	Supply 2
	Drain	1	5				
6	Extract	4	4				

Hot = Incoming hot water only, independent of Set Points.

C. Temp = Controlled Temperature, incoming hot/cold water regulates bath temperature to Set Point 1.

Blend= Incoming hot/cold water mix independent of Set Points.

Set Point 1 = Controlled Temperature = "SP".

Set Point 2 = Heater = "SP" + "AL" (Note: With the time while heating switch OFF the program time will not advance until Set Point 2 temperature is reached).

(*) Solid Chemical dispensing system will automatically dispense detergent at the start of all formulas. Bleach is dispensed for Formula I only for a minimum of 25 seconds after start of formula (Supply 1) and after detergent flush is completed.

TABLE 1-2
MAINTENANCE TEST FORMULA

KEY SWITCH

<u>Step</u>	<u>Operation</u>	<u>Step Time</u>	<u>Descending Time</u>	<u>Water</u>	<u>Set Point</u>	<u>Water Level</u>	<u>Supplies</u>
1	Break/Suds	1	9	Hot	Set Pt. 2	Low	Supply 1
	Drain	1	8				
2	Extract	1	7				
3	Rinse	1	6	C. Temp	Set Pt. 1	Low	Supply 2
	Drain	1	5				
4	Rinse	1	4	Blend	N/A	High	
	Drain	1	3				
5	Rinse	1	2	Cold	N/A	High	
	Drain	1	1				

TABLE 1-3

SPECIFICATIONS: Model DW1500HNSWE-13A

NSN:

APL:

Description: Steam Heated, Programmable Logic Controller, Non-Modular

Capacity: 150 Pounds, Three Pocket

Dimensions: 66" W x 51" D x 72" H

Cylinder: 48" x 26", 27.21 cu. ft.

Weight: 3,200 LB

Electrical: 440/60/3, maximum demand AMPS/10 SEC: 9

Wash Motor: 2 hp, 1750 rpm, 3.2 FLA

Extract Motor: 2.5/2.5 hp, 1675/840 rpm, 5.8/9.0 FLA

Potable water: 2" NPT rated @ up to 150 PSI, Hot and Cold

"G" Force: 59 @ 295 RPM Low, 237 @ 590 RPM High

Steam Heat: 1-1/4 NPT rated @ up to 125 PSI Supply and 3/4" NPT Return

Low Pressure Air: 1/4" NPT @ 80 - 100 PSI, 3.5 cu. ft./hr

Drain: 6" NPT

TABLE 1-4
SPECIFICATIONS: Model DW2000MNSWE-13A

NSN:	
APL:	910800025
Description:	Steam Heated, Programmable Logic Controller, Non-Modular
Capacity:	200 Pounds, Three Pocket
Dimensions:	65 1/2" W x 57" D x 72" H
Cylinder:	48" x 33", 34.54 cu. ft.
Weight:	3,300 LB
Electrical:	440/60/3, maximum demand AMPS/10 SEC: 9
Wash Motor:	2 hp, 1750 rpm, 3.2 FLA
Extract Motor:	2.5/2.5 hp, 1675/840 rpm, 5.8/9.0 FLA
Potable water:	2" NPT rated @ at up to 150 PSI, Hot and Cold
"G" Force:	59 @ 295 RPM Low, 237 @ 590 RPM High
Steam Heat:	1-1/4 NPT rated @ up to 125 PSI Supply and 3/4" NPT Return
Low Pressure Air:	1/4" NPT @ 80 - 100 PSI, 3.5 cu. ft./hr
Drain:	6" NPT

FIGURE 1-1
General View of Machine
150 lb. Models

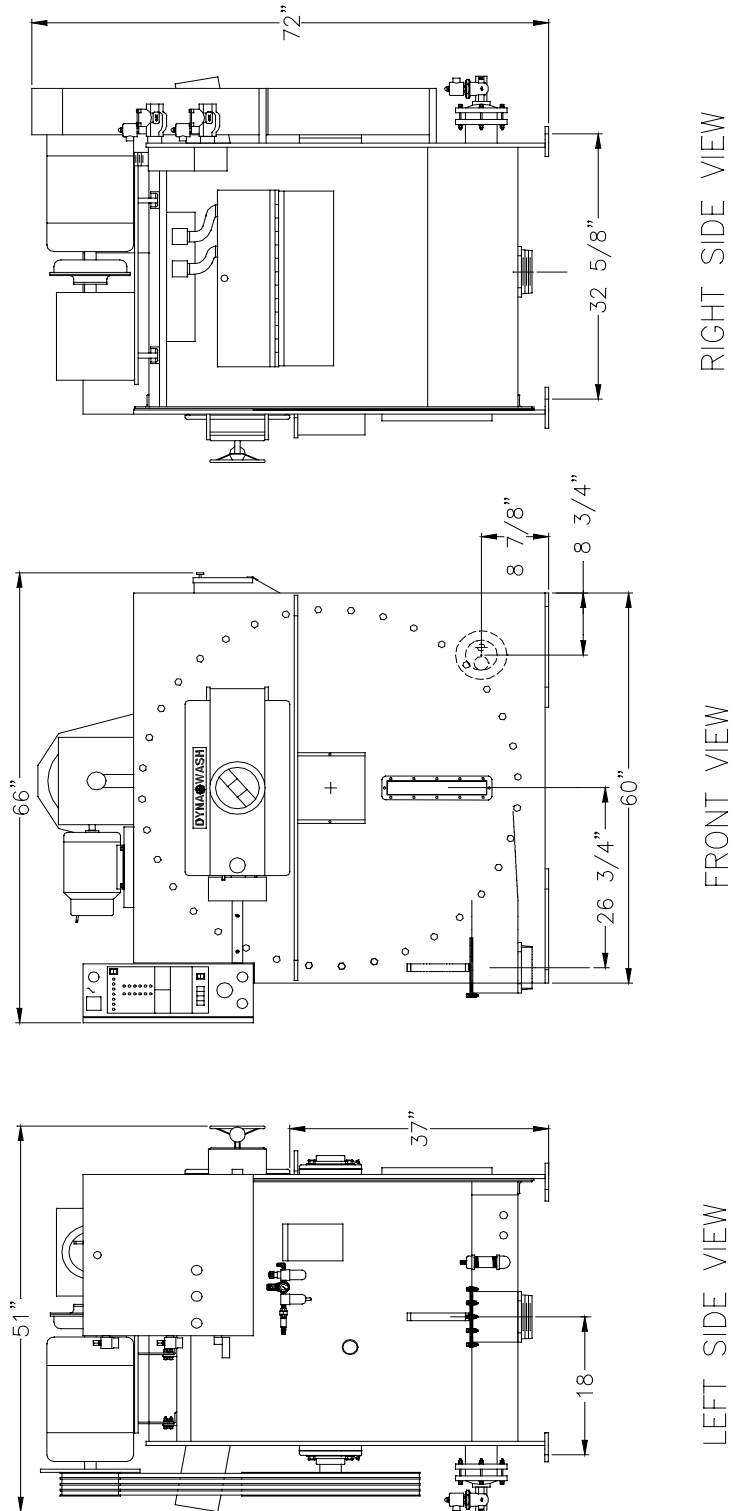
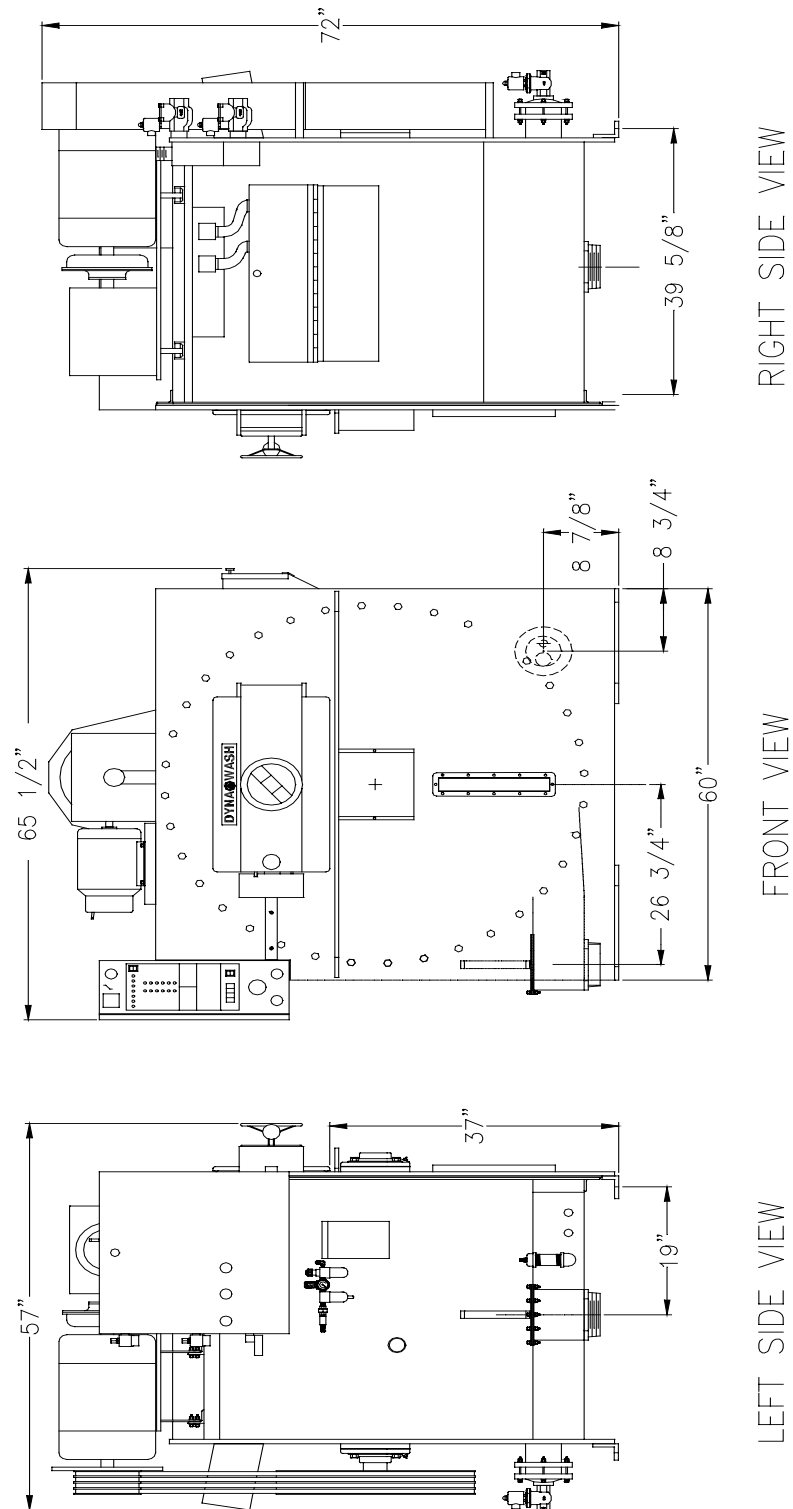


FIGURE 1-2
General View of Machine
200 lb. Models



1-5 RECEIPT and INSPECTION

1-5.1 Receiving Equipment. First and foremost, inspect the shipping pallet and box for any damage, which may have occurred during shipment. If any damage seems evident, notify the shipper and factory immediately. Follow instructions in 1-5.3, Damage to the Equipment During Shipment. If no damage to equipment exists, proceed with Section 1-5.2 Unpacking Equipment.

1-5.2 Unpacking Equipment. The machines are shipped on wooden pallets with either protective stretch wrap or enclosed in plywood boxes. Upon receipt of shipping package, inspect entire shipping package, and then remove wrapping or disassemble shipping box from pallet. Remove plastic wrap around the machine. Two (2) manuals are shipped with each machine, which are located inside the electric control box. The footings of the machine are bolted to the wooden pallet. Remove bolts from footing.

1-5.3 Damage to the Equipment During Shipment. Notify EDRO and the trucking company immediately of any damage to the equipment during shipment. Note all damage on the Bill of Lading. EDRO Corporation is not responsible or liable for any damages incurred from trucking companies or warehousing facilities. Standard EDRO DynaWash® warranty applies.

CHAPTER 2

SHIPBOARD INSTALLATION

WARNING

Improper installation can render the machine unsafe for operation and contribute to serious personal injuries, including but not limited to, multiple fractures, traumatic amputations, or death.

2-1 INTRODUCTION

The following procedures are recommended for shipboard installation of EDRO DynaWash® washer-extractors. Certain specifications may be modified to suit particular shipboard conditions however the basic principles should be adhered to for best results. For additional installation requirements not described in this technical manual refer to Naval Ships' Technical Manual, Chapter 655, "Laundry and Dry Cleaning".

CAUTION

The deck that supports the machine must be strong and rigid enough to support, with a reasonable safety factor and without undue deflections, the dead weight of the machine and the repeated forces transmitted to the deck by this type of rotating machinery. The foundation and supporting structure must be of adequate mass to counteract the largest possible out-of-balance force that may be generated.

2-1.1 Foundation. Rigid mount machines must be securely anchored to a hull foundation.

2-1.1.1 Framework. The framework should be constructed of angle iron to enable convenient anchoring of the machine to the frame, yet not raising the machine too high for comfortable operation. The framework must be reasonably flat and level and rigid in order to minimize deflection under the stresses created by the machine in motion. The width of the angle shall ensure the feet of the machine are fully supported by the framework. Figure 2-1 details the mounting bolt pattern ("footprint") of the machines.

2-1.1.2 Alignment and Anchoring. The method of fastening the machine to the framework should provide positive anchoring and proper alignment. Proper alignment shall be achieved through the use of shims and grout to ensure the machine is level and rest solidly on all four corners.

Place the machine on the frame and install shims under the feet to assure the machine is level right to left and front to back. Raise the machine and apply industrial strength non-shrinking grout to the framework. Ensure all areas under feet are completely filled with grout. (Any voids existing in these areas are likely to magnify vibration and cause unsatisfactory operation.) Lower the

machine onto the grout, carefully aligning the bolt holes. After the grout has cured completely, install all foundation nuts and bolts (1" diameter) and hand tighten until they contact framework. Prior to tightening bolts operate the machine empty in high-speed extract. Any misalignment will result in a noticeable vibration. If properly leveled and shimmed the machine will run as smooth as if bolted solidly to the base. Tighten all bolts evenly using one-quarter to one-half turn at a time and skipping from front to back and left to right frequently to ensure that all the bolts are uniformly tight. Recheck tightness of bolts following the first few loads.

2-1.2 Service Connections

2-1.2.1 Air Vent. If the drain is piped directly to the drainage system provisions must be made for an air vent to exhaust the air passing through the washer-extractor to obtain full advantage of the TurboXtract Air Stream Extraction principle.

2-1.2.2 Water. Separate hot and cold water connections must be provided to fit the valves on the machines at approximately 30-PSI. The water connections are 2" NPT. Install shut-off valves on each line. Furnish unions at each connection to permit valve removal for maintenance, if necessary. A branch line feeding the chemical supply bin is provided off of the machine's hot water line.

The machines have a provision for a salt-water connection. Salt-water connection is for emergency use only and shall not be plumbed.

2-1.2.3 Low Pressure Air. Provide low-pressure air connection, with a shut-off valve, between 80 PSI and 100 PSI. The machine will not operate below 80 PSI. The air connection is ¼" NPT. The compressed air requirement is 3.5 cu.ft./hr. All machines come equipped with an air filter, oiler, and pressure regulator.

2-1.2.4 Electricity. Because of the high torque motors and momentary high surge of current, heavy wires and large fuses are required. Use #6 AWG copper wire and 60 AMP fusible circuit breaker for steam heated machines.

Run three wire, #6 AWG from the power panel to a convenient spot on the back of the electrical control box of steam heated machines. Attach the wires to the L1, L2 and L3 terminals of the low extract contactor.

2-1.2.5 Heating Element. Model -13A is equipped with an indirect steam heater. Provide steam supply and condensate return lines. Steam pressure of 100 PSI is required for optimum efficiency. The steam connections are ¾" NPT.

CHAPTER 3

SET-UP AND OPERATIONAL TEST

3-1 INTRODUCTION

This chapter provides the post installation set-up procedures which must be accomplished prior to machine operation and a recommended operational test procedure to verify satisfactory operation. Complete operational guidance is described in Chapter 4, which must be completely understood before operating machine.

3-1.1 Set-up Procedure. Prior to operation the following set-up and verification steps shall be accomplished:

- a) Fill oiler glass jar with S.A.E. 10 oil.
- b) Adjust oil regulator to permit (1) drop of oil every (5) minutes.
- c) Adjust main air regulator to 80-85 PSI.
- d) Adjust brake air regulator to 40-45 PSI.
- e) Verify low air pressure switch is set to 50 PSI, adjust if necessary.
- f) Verify wash motor gear reducer is filled to proper level.
- g) Verify wash and main drive sheaves, belts and pulleys are aligned.
- h) Verify main drive belt deflection is $\frac{3}{4}$ " or less.
- i) Verify wash belt deflection is $\frac{1}{4}$ " or less.
- j) Verify vibration switch is properly adjusted to account for ship's motion and is in the operational position.

3-1.2 Operational Test - Automatic Mode. Conduct operational test in accordance with the following procedure. Record result for each machine on Test Data Recording Sheet, Appendix 1, Section 1-1.

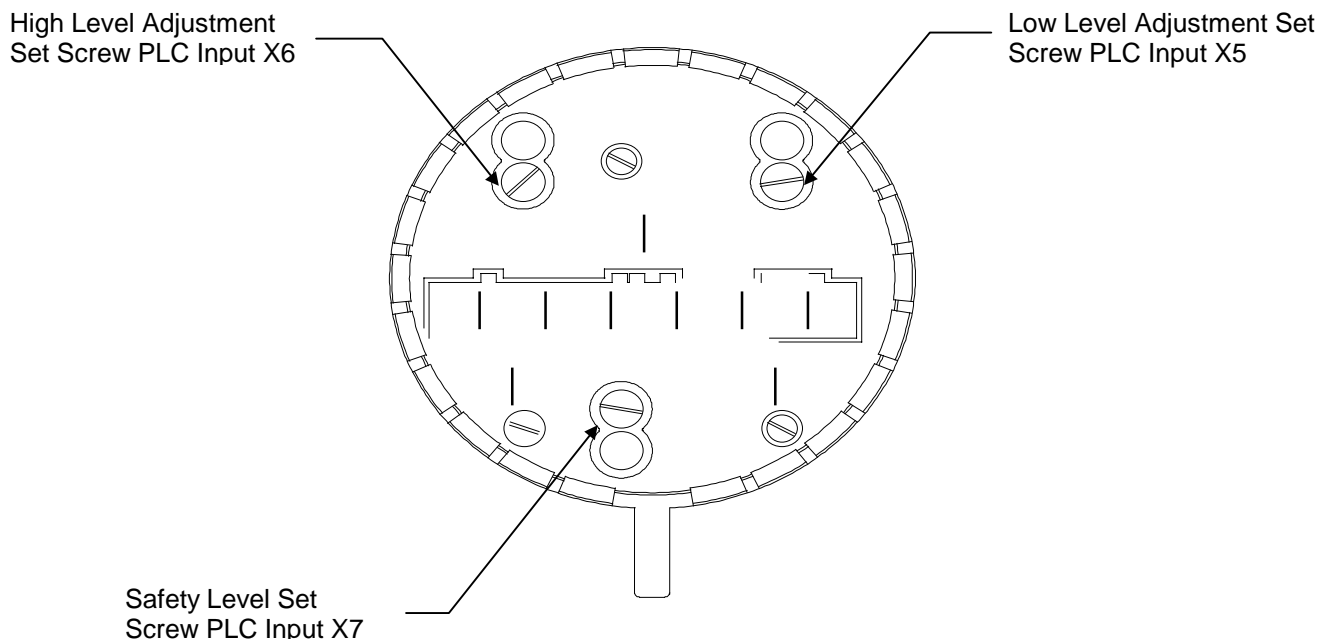
- a) Complete set-up procedure (Section 3-1.1).
- b) Ensure vibration switch is in the upright position. Verify Formula push-buttons and Power ON rocker switch are in the OFF position and Emergency Stop button is engaged (in position). Energize the machine. Verify Power ON, if present, and Emergency Stop lights are illuminated.
- c) Open shell door and disengage Emergency Stop button (out position). Ensure inner cylinder doors are properly closed and secured. Verify JOG operation. Verify two-hand operation in both directions. Verify clockwise cylinder direction in FWD mode

and counter clockwise direction in REV mode. Verify proper operation of electric wash motor brake. Leave shell door open.

- d) Turn Power ON rocker switch to ON position. With shell door open depress Formula 1 push-button to the ON position. Verify machine does not start. Close shell door. Verify low air indicator light is off and machine starts. If low air light is illuminated ensure air setting of 85 PSI and air pressure switch setting of 50 PSI. Adjust if necessary. Depress Emergency Stop button to the off position and verify machine stops. Depress Formula 1 push button to the OFF position. Reset Emergency Stop button to the out position.
- e) Place test load in washer-extractor ensuring load is equally distributed among the (3) pockets. Close and secure inner doors and shell door. Verify PLC control circuit is energized. (Circuit is energized if Power ON, Brake and Drain lights are illuminated, and temperature gauge is energized).
- f) With the control circuit energized reduce air pressure regulator below 50 PSI. Verify low-pressure air indicator light illuminates when pressure drops below 50 PSI. With low air light illuminated depress Formula 1 push-button to the ON position and verify machine does not start. Secure machine and adjust air pressure switch **IF** required. Depress Formula 1 to the OFF position. Reset air pressure regulator to 85 PSI.
- g) Depress Formula 1 push-button to activate the Formula. Verify low water level of approximately (4) inches on steam heated (Type I) machines. Turn Formula 1 OFF and allow the machine to drain. Depress Formula 3 push-button to activate the Formula. Verify high water level of approximately (9) inches. If water levels require adjustment secure and tag-out machine and adjust level(s) to the proper settings. (See Figure 3-1)
- h) Depress Formula 1 push-button to activate the Formula. Allow machine to fill. Turn Formula 1 OFF and allow the machine to drain. While machine drains verify proper setting of safety water level. (PLC indicator light corresponding to X7 shall not illuminate until the water level in the shell drops a minimum of (2) inches below the low water level). If safety water level requires adjustment secure and tag-out machine and adjust level to the proper setting. (See Figure 3-1)
- i) Adjust temperature Set Point 2 (See Section 4-1.3) to approximately 20 °F above actual bath temperature. (Higher setting is to ensure heater will energize during OP TEST to verify heater function). Turn the time while heating rocker switch to the OFF position.
- j) Depress Formula 1 push-button to activate formula. Verify proper operation of drain, hot water valve, air brake, wash motor and clutch. Verify operation of automatic solid chemical dispensing output (Y26).
- k) After machines fills to proper level verify booster heater energizes properly.
- l) Turn time while heating switch to the ON position. Verify formula step time 1 advances. Verify heater remains energized.

- m) Reduce Set Point 2 temperature below actual bath temperature. Verify booster heater de-energizes.
- n) Allow machine to continue through formula. While machine fills during Step 2, 4 and 5 of wash formula adjust temperature Set Point 1 above and below actual bath temperature while machine fills and verify proper operation of Controlled Temperature operation. Monitor machine through entire formula to cycle end and verify and record the results on the Test Data Recording Sheets.
- o) Verify proper operation of temperature gauge and time while heating switch. Applies to formula step 1 (Set Point 2, heated bath) only.
- p) Manually trip vibration switch and verify control circuit de-energizes and emergency stop indicator light illuminates. Following test adjust Set Point 2 to 130 °F.

Figure 3-1
Water Level Switch



Water level adjustment instructions: to lower level settings, rotate set screw counter-clockwise; to raise level settings, rotate set screw clockwise. PLC inputs X5 and X6 will illuminate when water level is attained. X7 will illuminate when water level drains below a safe level for extraction step. Machine will not extract unless X7 is illuminated.

3-1.3 Operational Test - Manual Mode. Conduct operational test in accordance with the following procedure. Record result for each machine on Test Data Recording Sheet, Appendix 1, Section 1-2.

- a) Connect hand-held remote control cable to pin connector on rear of control box. Energize machine and control circuit. Operate each manual push button and verify the proper activation of each corresponding device. Record the results on the Test Data Recording Sheets.

3-2 POST TEST CHECK-OUT

Following initial test operation check and tighten foundation bolts, main bearings and bearing set screws and check alignment and tension of main drive belts and motor drive belts and adjust as necessary.

CHAPTER 4

OPERATING INSTRUCTIONS

4-1 INTRODUCTION

This chapter describes the operational characteristics of the washer-extractor and complete operational instructions.

4-1.1 Programmable Logic Control. The washer-extractor is controlled automatically by the EDRO DynaWash® Series4A Programmable Logic Controller (PLC). The PLC is a simple push-button control interface preprogrammed with the (3) standard Navy wash formulas and one short cycle test formula. The PLC is fully automatic and therefore capable of controlling all operating aspects of the programmed formula including fill, wash, heat, drain, rinse, extract, chemical supply injection and all phases of clutching and braking. Operator interface is thus curtailed to an absolute minimum, the operator simply has to load the laundry and chemicals and press the desired formula button. Unlike electro-mechanical or microprocessor controlled washer-extractors, the PLC can not be reprogrammed in the field or operated in manual mode other than for troubleshooting purposes. Figure 4-1 depicts the PLC electrical control front panel.

4-1.2 Operation. Prior to loading and unloading ensure all formula push buttons and key switch are in the "OFF" position. EDRO DynaWash® washer-extractors with the Series4A PLC control are uniquely designed specifically for shipboard application. The washer-extractor is simple to operate and requires minimal operator interface. Simply load the three inner compartments of the machine with equal amounts of laundry (each compartment shall not vary by more than 10%), close and secure the inner and main shell doors, add the required chemicals to the appropriate supply bin, verify the correct temperature settings (see 4-1.3) and press the desired formula button. The PLC automatic formula control unit will operate the machine through cycle end in accordance with the formula selected (Table 1-1). At cycle end, depress the formula push-button and unload the three compartments.

4-1.3 Temperature Selection. The digital dual set point temperature gauge is set by selecting the controlled temperature for set point 1 and the heated bath temperature for set point 2. Set point 1 controls the incoming hot and cold water to temper the water to the approximate set point 1 setting. Once the machine fills the timer will advance regardless of the actual bath temperature. Set point 2 controls the heater function. With the time while heating switch OFF the timer will not advance until set point 2 is attained. To adjust set point 1, press the return key on the gauge until "SP" is displayed on the bottom left corner. Then use the up or down arrows to select the desired temperature setting. To adjust set point 2, press the return key until "AL" is displayed on the bottom left corner. Then use the up and down arrows to select the difference between set points 1 and 2 which will provide the desired set point 2 temperature (i.e. the difference between the two temperature values should be the value of the "AL" setting). For example, if set point 2 is 160°F and set point 1 is 130°F, then the setting of "SP" is 130 and the setting of "AL" is 30. Set point 2 is equal to "SP" + "AL" and is not a direct setting.

FIGURE 4-1
EDRO Series4A PLC
EXTERNAL LAYOUT OF CONTROL

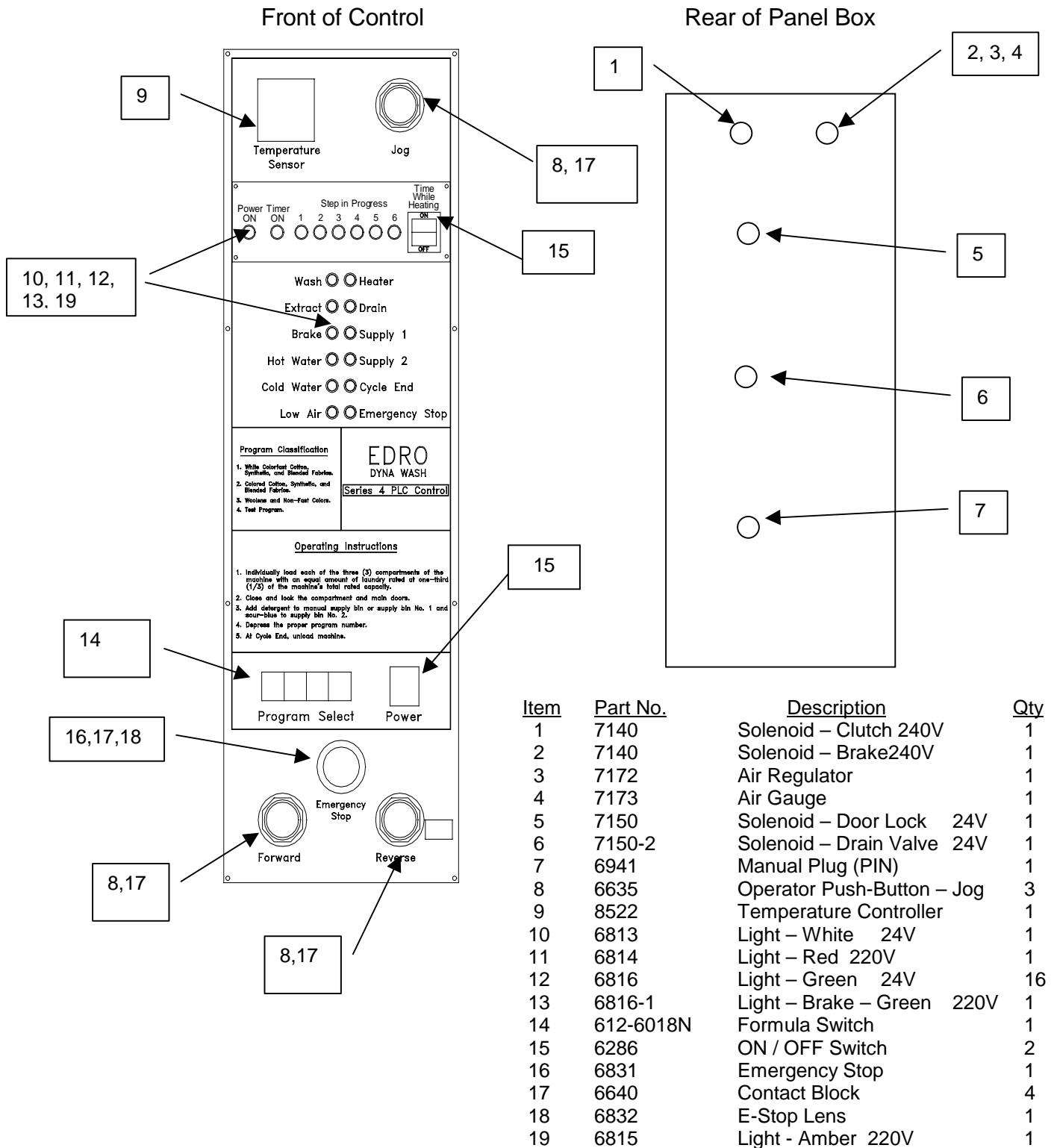
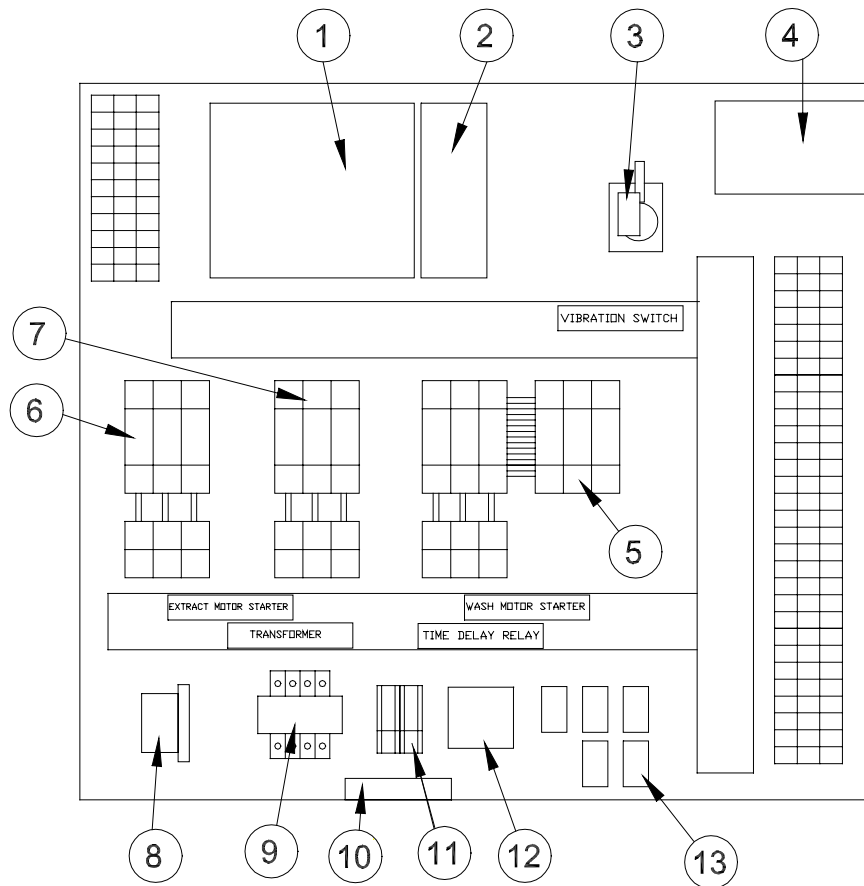


FIGURE 4-2
EDRO Series4A PLC
ELECTRICAL PANEL LAYOUT



Item	Part No.	Description	Qty
1	6971	P-L-C I/O Unit	1
2	6971-1	Expander Unit	1
3	6600	Vibration Switch Assembly	1
4	8522	Temperature Control	1
5	6461	Wash Starter	1
6	6462	Low Extract Starter	1
7	6462	Hi Extract Starter	1
8	6092	Buzzer	1
9	6660	Transformer 220/24	1
10	6096	Water Level Switch	1
11	6385	Fuse Block	2
12	6344	Time Delay Relay	1
13	6266	Relay 24V DPDT	5

Items not shown: Part No. SMI-EPROM-4A, Eprom Chip Qty = 1; Part No. 8516, Temperature Probe Qty = 1; Part No. SM0-553-F3116X, Part No. SHE-175, Noise Suppressor Qty = 16; Part No. 6685, Transformer 440/220 Qty = 1; Part No. 6270, Switch – Air Pressure Qty = 1; Part No. 6380, Fuse – 10 AMP Qty = 2; Part No. 6380-2, Fuse – 5 AMP Qty = 1.

TABLE 4-1
WIRING PROGRAMMING COLOR CODE

Wire Number	CIRCUIT	COLOR CODE	Wire Number
20	24 VAC Common	gray	20
20A	24 VAC	white-gray	20A
21	Wash	pink	21
22	24 VAC Ground	black	22
22A	24 VAC	white-black-red	22A
25	Low Extract	yellow	25
25H	High Extract	white-green-brown	25H
28	Drain	purple	28
35	Heater	red	35
38	Hot Water	orange	38
39	Cold Water	green	39
41	Supply	orange-black	41
42	Supply	red-black	42
43	Supply	blue-green	43
44	Supply	green-black	44
55	Signal	brown	55

4-1.4 Start Up. Prior to machine operation verify proper utility service (electrical, pneumatic and steam (if applicable)). Verify the vibration switch and Emergency Stop button are in the proper operating position, otherwise the machine will not run or "JOG". For the machine to be in the ready to run condition, the shell door must be closed and secured and the power ON rocker switch must be on. In the ready to run condition the Power ON, Brake and Drain indicator lights will be illuminated indicating the PLC is energized, the disc brake is engaged and the drain is opened. If inadequate air pressure is present the Low Air light will illuminate and the machine will fail to operate.

The EDRO DynaWash® Series4A PLC push buttons engage and disengage complete formula cycles by always starting at step 1 of any of the desired formulas when the particular push button is engaged. Once the formula is engaged, the machine will complete all steps of the preprogrammed formula, as long as the selected formula button remains engaged and the control circuit remains energized. If the formula is interrupted for any reason the machine will stop and the formula must be restarted from the beginning. Once initiated the formula can not be paused or stopped at any point within the formula without having to automatically reset to the beginning.

4-1.5 Program Features. The following program features, many of which are included in the troubleshooting sections, are reiterated below so the operator has a clear understanding of the complete operational characteristic of the washer-extractor and to aid in recognizing a condition which may result in an apparent malfunction in the formula or machine:

- a) In Step 1, which calls for electric or steam heat, if the time while heating (TWH) switch is OFF, the timer will not advance until set point 2 temperature (heater) is attained.
- b) In Step 1, which calls for electric or steam heat, if the time while heating (TWH) switch is ON, the timer will advance even though set point 2 temperature is not attained. The TWH switch is active and will turn the timer ON or OFF while the heater is energized for the first time in that step. However, once set point 2 temperature has been reached the first time, the TWH switch becomes inactive and the step timer stays on until the end of the step. The heater will de-energize once set point 2 temperature is attained, and will continue to cycle ON and OFF as needed at 5 minute intervals to maintain set point 2 temperature, regardless of the TWH switch setting.
- c) The timing of the wash formula will not advance until the proper water level is attained.
- d) The formula program time is not advancing if the timing indicator light is OFF.
- e) Set point 1 controls the incoming mix of hot and cold water to attain the approximate temperature setting. Once the water level is reached the formula time will advance regardless of actual bath temperature. The booster heater is interlocked with set point 2 only.
- f) The steam booster heater will not energize until the low water level is attained.
- g) The PLC is programmed to enable use of either powder detergents or solid cake detergents. Powder detergent and sour are added to the chemical supply bins prior to each load and automatically dispensed at the appropriate formula times. Solid cake detergents are dispensed by a remote, separately installed dispensing cabinet. PLC output (Y26) is programmed to energize for 3, 5 and 7 seconds at the beginning of formulas I, II and III respectively to identify to the remote system which formula is in

operation. Detergent will dispense at the beginning of all formulas. Bleach is dispensed for formula I only a minimum of 25 seconds after start of formula (Supply 1) **and** after detergent flush is completed.

- h) Time for the extract cycle does not include time for directional sequencing of motors (+/-15 sec), and braking.
- i) In the wash cycle the machine will stop if the shell door is opened. In extract, the door is locked and cannot be opened until the cylinder is assured to be at a complete stop.
- j) The machine will stop if the control circuit is de-energized at any time during the cycle. The circuit will be de-energized if the shell door is opened, the vibration switch is tripped, the Emergency Stop button is depressed, the engaged formula button is depressed, the master switch is turned off or a loss of air occurs. If the formula is interrupted the entire cycle must be run from the beginning.
- k) Once tripped the vibration switch must be manually reset.
- l) The wash motor will not operate on low air pressure (less than 50 PSI) to prevent clutch slippage and consequent overheating. Likewise the extract motor will not start unless air is exhausted and the clutch released.
- m) The machine will not extract with water in the shell (PLC input terminal X7 must be illuminated). However, the formula time will continue to advance as if the machine was in extract mode.
- n) A formula push-button can not be depressed if another push button is already depressed.
- o) After running test formula (Key Switch), it is necessary to turn the power on/off prior to running formulas 1-3. Failure to do so will cause formulas 1-3 to run with the test formula parameters.
- p) In addition to thermal overloads (heater coils) on the motor starters each extract motor winding is equipped with built-in thermoguards (line X-1 and X-2) that open when temperature passes safety point. Heater coils can be reset within 5 - 10 minutes, however it will take up to 1/2 hour for thermoguards to close contacts.
- q) In case of power failure or turning off the master switch, the pneumatic disk brake will engage automatically. The brake will also engage if a loss of air occurs.
- r) Cycle end procedure includes a 15-second fluff step during which time the wash motor will energize in the reverse direction one second after the clutch engages. At the end of the 15 seconds, the cylinder will stop, the clutch will disengage, the brake will engage, the cycle end light will illuminate, and the buzzer will sound. The buzzer will stay on for 15 seconds and then shut off. The cycle end lamp will remain on until all pushbuttons have been reset.

CHAPTER 5

MAINTENANCE INSTRUCTIONS

5-1 POST INSTALLATION MAINTENANCE

During the first few weeks of operation the machine requires continuous check-ups. A number of adjustments should be made and the bolts and nuts tightened if they become loose. This is required due to the settling of the machine in place as well as expansion from heat and motion. The following checks are required:

- a) The foundation bolts must be checked periodically and tightened if necessary.
- b) The bolts and nuts on the shell plating may become loose from the softening of the gasket and therefore should be re-tightened at least once even though no leaks develop.
- c) Check the taperlock bushing screws on all pulleys, especially the main drive. If any looseness is observed, tighten, recheck and if found tight there is no need to check again. Verify that pulleys have not moved from original position.
- d) Check at least once the taper bushing screws on the clutch as they have a tendency to loosen from heat and constant jogging.
- e) The initial wear on the disc brake will be more rapid in the first few weeks and the brake should be adjusted as needed. Air pressure regulator gauge should be checked and adjusted if necessary.
- f) The brake on the wash motor needs less adjustment and should not be tampered with unless the indicator on the motor points to "adjust". When adjusting ensure the electricity is off and that the gap between the coil and the lever is $\frac{1}{2}$ " so the braking action will work at its best.
- g) Check the tightness of the front and rear main bearings, and cylinder shaft sleeve set screws.
- h) Check the tension of the belts on the main pulleys. These steel cable belts have very little stretch and usually one adjustment is all that will be necessary.
- i) After two weeks, change the oil in the reducer, grease the bearings and put a few drops of oil on the door hinges and door lock.

5-2 PERIODIC MAINTENANCE. Figure 5-1 identifies specific lubrication points described below.

5-2.1 Main Bearings. Grease bearings once a month. If bearings become noisy, it does not necessarily mean they have to be replaced. Usually it is a lack of grease, but sometimes they may have to be adjusted for less clearance.

5-2.2 Motors.

5-2.2.1 Motor Operating Characteristics.

- a) The ambient temperature of the air surrounding the motor should not exceed 40°C or 104°F unless the motor has been designed for high ambient temperature applications. Obstructions should not be placed around the motors to obstruct free air flow.
- b) Check the motor nameplate and ensure that the correct power supply (voltage, frequency and phase) is being used and that the motor is connected in accordance with the connection diagram on the nameplate.
- c) The motor is designed to operate with a maximum voltage variation of +/- 10% from the nameplate voltage. If these variations are exceeded, the motor may exceed the nameplate temperature rise.
- d) On the rear shaft extension, the bearing construction on the extract motor, note that the bearing inner race is locked on the shaft by a lock nut, and the outer race is locked in the bearing bracket by the fit of the bearing cap. This prevents end play and rotation of the bearing outer race. Note the large chamber, which is packed with an ample supply of grease at the time of manufacture. The front bearing is not locked, but is permitted to float for expansion and contraction of the shaft due to heating.

5-2.2.2 Wash Motor Gear Reducer. Change oil in the gear reducer after two weeks of operation and every six months after. When greasing, the following steps should be followed:

- a) Clean the exterior of the plugs.
- b) Remove fill, vent, drain and level plugs.
- c) If grease has hardened, run a rod or wire a short distance into the chamber to break grease.
- d) Fill motor with oil (AGMA #8) and run motor until new oil flows from drain plug.
- e) Reinstall drain plug and fill to proper level.
- f) Run motor until new oil flows from level plug.
- g) Replace fill, level and vent plugs.

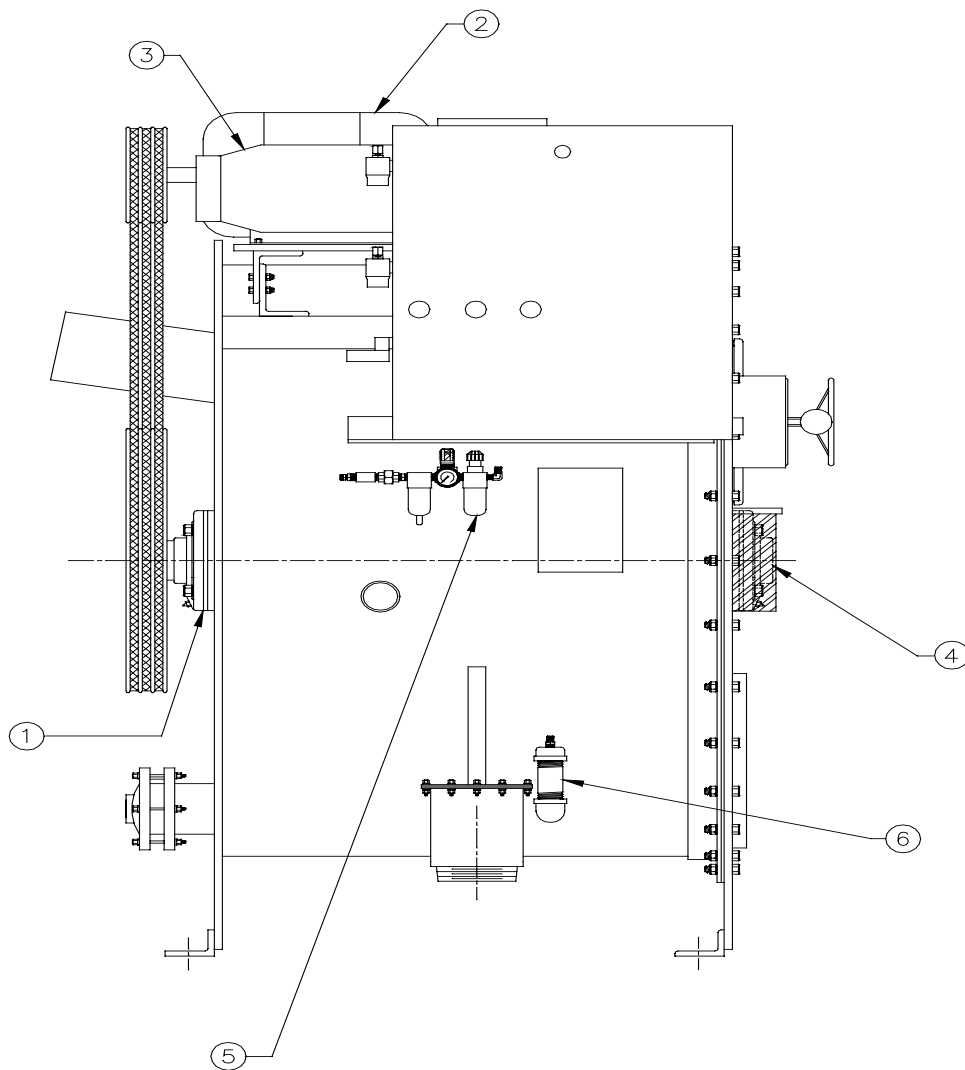
5-2.2.3 Extract Motor Bearings. Under normal operation conditions, it is only necessary to re-grease a ball bearing motor every two to six years, depending upon the motor speed and operating conditions. Due to the severe operating conditions of shipboard washer-extractors the motors should be greased once a year. A sound greasing procedure should be followed when re-greasing a motor for it has been determined that the greatest cause of bearing failure is over greasing rather than under greasing.

5-2.3 Air Filter. Drain water from air filter and refill oil jar as needed. Adjust the oil regulator to permit (1) drop of oil in (5) minutes.

5-2.4 Belts. Keep belts tight, especially on wash motor. A screeching sound during pick-up of cylinder is an indication of belt slipping.

5-2.5 Miscellaneous Lubrication. Put a few drops of graphite or light oil on the front door hinges and lock pin.

Figure 5-1
Lubrication Diagram



<u>Item</u>	<u>Description</u>
1	Rear Bearing
2	Extract Motor
3	Wash Motor
4	Front Bearing
5	Air Filter
6	Pressure Bowl / Water Level Sensor

CHAPTER 6

TROUBLESHOOTING GUIDANCE

6-1 INTRODUCTION

This chapter provides troubleshooting procedures, information and instructions to identify and correct equipment malfunctions. Troubleshooting is the systematic analysis of a malfunction to identify the cause of the malfunction. It requires a thorough understanding of the equipment operation and an ability to recognize the symptoms of a faulty operation. Troubleshooting procedures are divided into three phases: identification of the symptom or malfunction, identification of the probable cause and performance of the corrective action. This chapter describes operational characteristics and general troubleshooting procedures. A troubleshooting table to assist in systematically identifying and correcting operational problems and equipment malfunctions is provided at the end of this chapter.

6-1.1 Preliminary Troubleshooting. Most symptoms/malfunctions may be detected by sight, sound, smell and touch. First, check components that have been recently repaired or have a history of failure. When a variation from the normal operating condition is noted, the symptoms and causes must be determined and recorded. Attempts should be made to reduce the most likely causes of a malfunction. Unusual sounds or overheating may point directly to certain components or parts. Also, components that have been recently installed or serviced are possibly the source of failure.

NOTE

In many troubleshooting cases the apparent malfunction may in fact be a result of a specific program feature or interlock. If the program does not appear to be advancing properly and the cause of the malfunction is not obvious refer to paragraph 4-1.5 in addition to the symptoms in Table 6-2.

6-1.2 Programmable Logic Controller. The advanced technology inherent in the Programmable Logic Controller (PLC) eliminates the requirement for electro-mechanical devices such as control relays and timers and allows for exact operation of the pre-programmed formulas through electronic circuits, timers and counters. The programming logic of the PLC is a sequence design method for applications where outputs (motor starters, solenoid valves, etc.) are controlled according to a sequence of achieved events or inputs (limit switches, push buttons, operator controls, etc.). The logic utilized in EDRO's Series4A PLC is ladder logic. Ladder logic deals with timers from data registers, counters, and functional outputs all directed by a single input signal. With the power of this PLC and its ladder logic program, the effective creation results in the transformation of timed, sequenced events, with a variety of safety interlocks, into a functional microprocessor able to monitor, and more importantly, control all operating aspects of the machine. This technology results in simple machine and operator interface, reliable and consistent formula operation, and precise and easy troubleshooting. Figure 6-1 depicts the PLC input/output terminals corresponding to the field device to which each individual terminal is connected. Table 6-1 identifies the specific function of each input/output and diagnostic recommendations.

6-1.2.1 General PLC Troubleshooting. When a PLC controlled machine or process stops, it is almost invariably a field device, such as a limit switch, solenoid valve or tripped

overload, that has caused the process to shut down. These field devices can be on the input or output side of the PLC. PLCs have proven themselves to be very reliable and have a wide range of complex applications, such as controlling machinery on automotive assembly lines, to simple applications such as controlling traffic signals. However, PLCs do sometimes fail. If a failure does occur it is important to be able to first make a decision as to whether the problem is in the PLC or in the field. The first thing to check when troubleshooting a PLC is to confirm the PLC power and run lights are on and the fault light is off. If the PLC power light is off there is likely an open circuit in the field power or control circuitry (see troubleshooting chart No. 1). The run light and fault light (PROG-E/CPU-E) on the PLC will identify if the program is running or has a fault. If the CPU run light is on and the fault light is out you can be confident the PLC has not failed internally. If the CPU is not running and/or the fault light is on, disconnect power to the machine for a few seconds and then switch it back on and attempt to run the formula. This may clear the fault on the PLC.

If the PLC still does not run the battery backup for program memory may be dead **if the PLC is not programmed with EEPROM type memory**. The contents of **RAM** program memory are retained by battery back-up as the contents of the memory may be lost in the event of power loss to the PLC. The battery is not used while the PLC is energized. The life cycle of the battery is dependent on how often the power to the PLC is disconnected. The battery should last a minimum of three years without power to the PLC and up to ten years if the PLC is continually energized. If power is lost and the battery is dead the program is lost and must be reloaded. This can be easily accomplished by installing a preprogrammed EEPROM chip supplied by the OEM into the appropriate pin terminal located in the recess behind the PLC's cover. EEPROM memory will not require replacement of the battery as the program memory is permanently stored in the EEPROM chip and when installed overrides the RAM program memory.

Note

The complete control circuit must be closed to energize the PLC and override the battery backup.

If it is determined the battery backup is not dead and the PLC fault remains, the problem is inside the PLC and the PLC input/output unit must be replaced.

If the PLC is running and not in the fault mode, troubleshooting of the field devices connected to the PLC must be accomplished. In order to facilitate troubleshooting, the maintenance personnel must have an understanding of the operation of the machine corresponding to the programmed formulas (i.e. knowing what the machine is supposed to be doing at a certain point in the formula and why). The formula chart (Table 1-1) provides the specific program sequence. If an output such as a solenoid valve, motor contactor, etc. is not activated and the corresponding PLC LED output indicator light is off (indicating output terminal is not energized) you must search backwards to determine what sequence or input is preventing the output from coming on. In most cases the search will lead to an input (level or bath temperature) that is not in the correct state to satisfy the programming logic. Refer to Figure 6-1 which shows the PLC layout identifying the specific input and output terminals corresponding to each field device.

When an input, such as the formula push button, level switch or temperature gauge, is found that is preventing the formula from proceeding, the specific physical input must be checked. Check the LED indicator light and corresponding voltage at the specific input terminal. If the LED light is out and no voltage is present at the terminal physically make the contact on the switch if possible. Monitor the corresponding PLC LED input indicator light. If the light goes on and the program

advances as anticipated the problem is in the switch. If light does not illuminate recheck the voltage at the input terminal. If no voltage is present on the input terminal the problem is an open circuit in the field wiring likely due to a loose connection on a terminal board. If voltage is present on the terminal point of the input board but the output status does not change, as indicated by the output devices themselves or the output indicator lights, the PLC input board and/or input relay is faulty preventing the program from advancing and the PLC must be replaced.

If the inputs are in the correct state (i.e. water level and bath set point temperature attained) and an output does not energize as shown by the PLC LED output indicator light, check the corresponding voltage at the output terminal. If voltage is not present the PLC output board and/or output relay is faulty and the PLC must be replaced. If voltage is present on the output terminal the problem is an open circuit in the field wiring or a faulty field device such as a stuck solenoid or a tripped overload.

Although the PLC LED indicator lights corresponding to each individual input/output are a convenient troubleshooting tool they do not guarantee the PLCs internal input/output relay has closed. The LED indicator lights are internally wired in **parallel** with the corresponding input/output relay therefore the light only indicates the program has sent the signal to close the relay. Therefore, the actual voltage must be measured at the terminal in question in order to verify the state of the terminal. For example, if the machine is supposed to be filling with hot water, output Y12 should be energized opening the hot water solenoid valve and the corresponding led indicator light illuminated. If the LED light is on but no voltage is present at the Y12 output terminal the internal relay is damaged and the PLC must be replaced. The internal relays can not be repaired. If voltage is present, there is either a break in the circuit going to the solenoid or the valve itself is stuck closed.

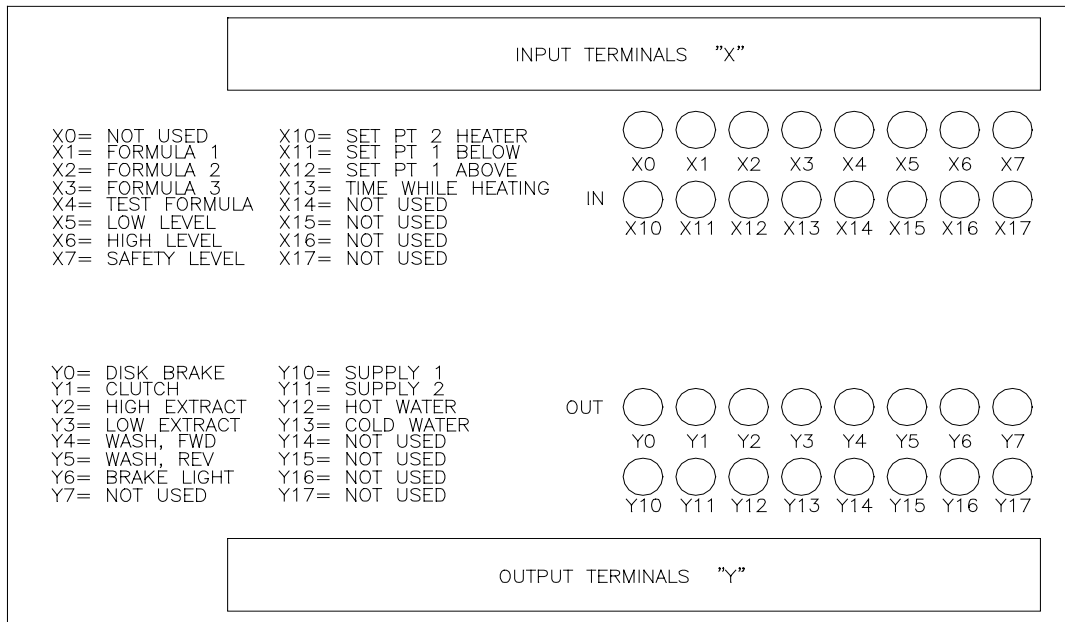
If an internal input or output relay is damaged it may be the result of an electrical short in the field device it is connected to. Therefore, it is imperative to troubleshoot and correct any electrical problem with the field device prior to replacing the PLC otherwise the new PLC will also fail.

In the majority of troubleshooting cases the underlying cause of the problem will be in the field devices or an open circuit in the field input/output wiring to the PLC.

6-1.3 Troubleshooting Procedures. Table 6-2 provides symptomatic problems that may occur with the washer-extractor and recommended corrective action to quickly identify and isolate the fault. The tables assist the repair technician in the logical selection of possible areas of trouble and lead to the most rapid determination of the fault. A list of possible symptoms directs attention to specific components and recommended corrective action. The type of malfunction and identification of the component then permits a logical decision to repair, replace or investigate further in order to correct the fault. A complete loss of control may be caused by two malfunctioning components acting together, repair of one cause may restore operation, but it may also permit a recurrence if the second malfunctioning component is not repaired.

FIGURE 6-1
PLC INPUT/OUTPUT DIAGRAM

Programmable Logic Controller



Output Expander

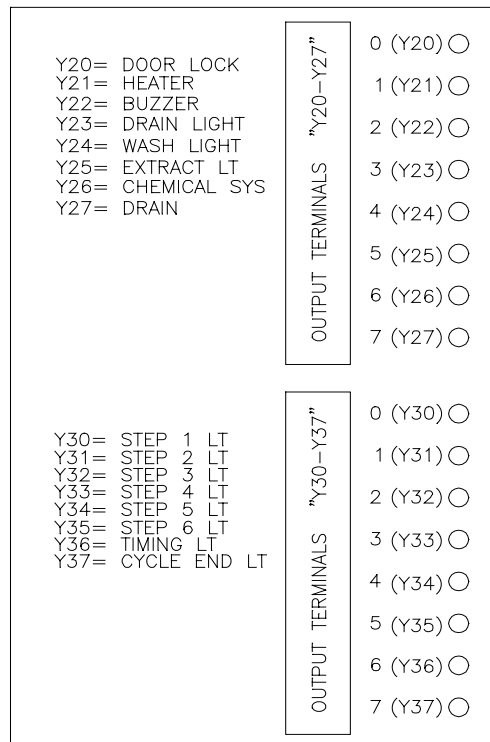


TABLE 6-1
PLC INPUT/OUTPUT FUNCTIONAL DESCRIPTION

The EDRO Series4A PLC may be monitored and diagnosed by looking at the input LEDs labeled with X's and output LEDs labeled with Y's.

INPUTS TO THE PLC:

- X1 : Formula 1. - When push-button for formula 1 is pushed in X1 LED should be ON. If LED does not go ON check the push-button it may be defective.
- X2 : Formula 2. - When push-button for formula 2 is pushed in X2 LED should be ON. If LED does not go ON check the push-button it may be defective.
- X3 : Formula 3. - When push-button for formula 3 is pushed in X3 LED should be ON. If LED does not go ON check the push-button it may be defective.
- X4 : Test formula. - When the key for test formula is turned to ON X4 LED should be ON. If LED does not go ON check the key switch it may be defective.
- X5 : Low water level. - When X5 LED is ON it is showing that the low water level has been reached. If low water level is reached and the LED fails to go ON first check the pressure bowl, it may be blocked. Then check the plastic tube connecting pressure bowl to the water level switch it should be air tight. Finally check the wire connection from water level switch to the PLC. If all is O.K. water level switch is broken or needs adjustment.
- X6 : High water level. - When X6 LED is ON it is showing that the high water level has been reached. If high water level is reached and the LED fails to go ON first check the pressure bowl, it may be blocked. Then check the plastic tube connecting pressure bowl to the water level switch it should be air tight. Finally check the wire connection from water level switch to the PLC. If all is O.K. water level switch is broken or needs adjustment.
- X7 : Safety water level. - When X7 LED is OFF it is showing that there is water in the machine. In this case the machine will not go into extract until the water is drained. If machine has no water but the X7 LED is OFF first check the pressure bowl, it may be blocked. Then check the plastic tube connecting pressure bowl to the water level switch it may be blocked. Finally check the wire connection from water level switch to the PLC. If all is O.K. water level switch is broken or needs adjustment.
- X10 : Heater temperature set-point 2. - When X10 LED is ON, set-point 2 has been reached and heater (steam or electric) should be turned OFF. If set point 2 has been reached and LED is not ON check the wire connections from temperature probe to temperature controller and from temperature controller to the PLC. If connections are O.K. than your temperature probe or your temperature controller is broken. Also, if X10 LED is ON before set point 2 is reached check the above connections if connections are O.K. than your temperature probe or your temperature controller is broken.
- X11 : Both X11 and X12 signal temperature set point 1. When below set point 1 X11 should be ON and X12 should be OFF. When above set-point 1 X11 should be OFF and X12 should be ON. If these conditions are not true check the wire connections from temperature probe to temperature controller and from temperature controller to the PLC. If connections are O.K. then your temperature probe or your temperature controller is broken.
- X12 : SEE X11.
- X13 : Time While Heating. – When X13 LED is OFF program time will not advance until set point 2 temperature is attained. When X13 LED is ON program time should advance and heater should be energized if actual bath temperature is below set point 2. If the time while heating switch is ON and X13 LED is OFF check wiring between switch and input terminal X13.

OUTPUTS OF THE PLC:

- Y0: Main Brake: When LED is ON brake should be disengaged. If brake is engaged check the brake solenoid.
- Y1: Clutch: When LED is ON clutch should be engaged. If clutch is disengaged check the clutch solenoid.
- Y2: High Extract: When LED is ON machine should be in high extract. If machine is not in high extract first check the overloads in the starter, then check the thermal overloads in the motor, and finally check the high extract starter.
- Y3: Low Extract: When LED is ON machine should be in low extract. If machine is not in low extract first check the overloads in the starter, then check the thermal overloads in the motor, and finally check the low extract starter.
- Y4: Wash Forward: When LED is ON machine should be washing in clockwise direction. If machine is not washing first check the overloads in the starter, then check the normally closed contact on the wash reverse contactor, and finally check the wash contactor.
- Y5: Wash Reverse: When LED is ON machine should be washing in counter clockwise direction. If machine is not washing first check the overloads in the starter, then check the normally closed contact on the wash forward contactor, and finally check the wash contactor.
- Y6: Brake Light: If brake light does not go ON check the light bulb.
- Y10: Supply 1: When LED is ON supply one should be ON. If supply 1 does not work check the supply 1 inlet valve. (Supply 1 will energize 25 seconds after start of formula).
- Y11: Supply 2: When LED is ON supply two should be ON. If supply 2 does not work check the supply 2 inlet valve.
- Y12: Hot Water: When LED is ON hot water should be coming IN. If Hot water fails to come IN check the hot water inlet valve. If the LED does not light up when hot water is needed check the water level switch.
- Y13: Cold Water: When LED is ON cold water should be coming IN. If cold water fails to come IN check the cold-water inlet valve. If the LED does not light up when cold water is needed check the water level switch.

Output Expander (Upper 8 Outputs)

- Y20 (Y0): Door lock: When LED is ON door is locked. If door fails to lock check the door Solenoid.
- Y21 (Y1): Heater: When LED is ON steam valve is open. If steam fails to come in check the steam valve.
- Y22 (Y2): Buzzer: When LED is ON buzzer should be ON. If buzzer fails check the buzzer.
- Y23 (Y3): Drain Light: If DRAIN light fails to go ON check the light bulb.
- Y24 (Y4): Wash Light: If WASH light fails to go ON check the light bulb.
- Y25 (Y5): Extract Light: If EXTRACT light fails to go ON check the light bulb.
- Y26 (Y6): Solid Chemical Dispensing System: Y26 output sends signal to remote solid chemical dispensing system to indicate which formula is running and begin dispensing of system. When push button is depressed to initiate formula, LED should illuminate for 3, 5 and 7 seconds for formulas I, II and III respectively. Bleach (formula 1 only) is dispensed after receiving signal from Y10 **AND** after detergent flush is completed. Sour is dispensed when supply 2 (Y11) energizes.
- Y27 (Y7): Drain: When ON drain should be closed. If drain fails to open check the drain solenoid.

Output Expander (Lower 8 Outputs)

- Y30 (Y0) through Y37 (Y7) are controlling the step indicator, timing and cycle end lights. When the timing light (Y36) is ON the formula time is advancing. If indicator lights do not illuminate check wiring and bulb.

TABLE 6-2
PLC TROUBLESHOOTING GUIDE

SYMPTOM	CORRECTIVE ACTION
1. FORMULA DOES NOT ACTIVATE PLC POWER/RUN LIGHTS OFF	<ul style="list-style-type: none"> • Check power supply/control circuit • Check 440V/220V transformer • Check fuses • Check vibration switch; reset if tripped • Check Emergency Stop push-button • Check 24V relay • Check door switch • Check 220V/24V transformer • Check power ON/OFF switch • Check low air switch
PLC POWER/RUN LIGHTS ON	<ul style="list-style-type: none"> • Check LED input indicator light corresponding to formula push-button (X1 for Formula 1). • If LED is illuminated, verify voltage to corresponding input terminal. • If voltage is present at input terminal corresponding to formula, check LED output lights and terminal voltages corresponding to wash motor, clutch, water valves, etc.
2. MACHINE QUICKLY CYCLES ON AND OFF WITH LOUD HAMMERING NOISE	<ul style="list-style-type: none"> • Verify air pressure gauge setting of 85 PSI (80 PSI minimum - 100 PSI maximum). • Verify low-pressure air switch setting of 50 PSI.
3. MACHINE DOES NOT FILL	<ul style="list-style-type: none"> • Check LED input indicator light corresponding to level (X5 for low) and LED output lights corresponding to drain (Y27) and water valve (Y12 for HOT). • X5 should be OFF indicating level has not been reached, Y27 should be ON indicating drain is closed, Y12 should be ON indicating solenoid valve is open. • Verify corresponding voltages. • If X5 is ON, level switch may be broken or out of adjustment. • If Y27 is ON and drain is open, check drain solenoid valve and air supply to drain cylinder. • If Y12 is ON, check voltage at water solenoid valve or valve may be stuck closed.

TABLE 6-2
PLC TROUBLESHOOTING GUIDE-CONT.

SYMPTOM	CORRECTIVE ACTION
4. MACHINE CONTINUES TO FILL	<ul style="list-style-type: none"> • Check LED input indicator light corresponding to level (X5 for low) and LED output light corresponding to water valve (Y12 for HOT). • X5 should be ON indicating level has been reached, Y12 should be OFF indicating solenoid valve is closed. • Verify corresponding voltages. • If X5 is OFF, pressure bowl may be clogged or level switch may be broken or out of adjustment. • If Y12 is OFF, solenoid valve is likely stick open.
5. WASH MOTOR WILL NOT START IN AUTOMATIC MODE	<ul style="list-style-type: none"> • Check LED output indicator lights corresponding to disk brake (Y0), wash motor (Y4 FWD, Y5 REV) and clutch (Y1). • Y0 should be ON indicating brake is disengaged. Y4 or Y5 should be ON indicating wash motor contactor has been energized. Y1 should be ON indicating clutch has engaged. • Check clutch. Check for sufficient air pressure. Check for leakage from clutch exhaust valve. • Check motor starter and heater coils. • Check brake. • Check is motor operates in JOG. • Check door switch circuit.
IN JOG	<ul style="list-style-type: none"> • Check door switch circuit. • Check vibration switch and Emergency Stop button. • Check clutch. Check for sufficient air pressure. Check for leakage from clutch exhaust valve. • Check brake.
<div data-bbox="852 1554 1437 1633" data-label="Text"> <p style="text-align: center;"><i>NOTE</i> JOG function is independent of PLC circuit.</p> </div>	

TABLE 6-2
PLC TROUBLESHOOTING GUIDE-CONT.

SYMPTOM	CORRECTIVE ACTION
6. HEATER DOES NOT ENERGIZE WHEN BATH TEMPERATURE IS BELOW SET POINT 2	<ul style="list-style-type: none"> • Verify set point 2 (SP + AL) is above bath temperature. • Check LED input indicator light corresponding to level (X5 for low) and set point 2 (X10) and LED output light corresponding to heater (Y21). • X5 should be ON indicating level has been reached (heater will not energize until level is reached), X10 should be OFF indicating set point has not been reached. If X5 is ON and X10 is OFF, Y21 should be ON indicating heater is energized. • Verify corresponding voltages. • If X5 is OFF, see No. 4 above. • If X10 is ON, wire connections may be loose or temperature probe or gauge is likely broken. • If Y21 is ON, heater should be energized. Check heater solenoid valve or contactor.
7. HEATER DOES NOT DEENERGIZE WHEN BATH TEMPERATURE REACHES SET POINT 2 (TIMER WILL NOT ADVANCE)	<ul style="list-style-type: none"> • Verify bath temperature is above set point 2 (SP + AL). • Check LED input indicator light corresponding to set point 2 (X10) and LED output light corresponding to heater (Y21). • X10 should be ON indicating set point 2 has been reached and Y21 should be OFF indicating heater is OFF. • If X10 remains OFF and Y21 remains ON, wire connections may be loose or probe or gauge is likely broken.
8. FORMULA DOES NOT ADVANCE TIME WHILE HEATING SWITCH OFF	<ul style="list-style-type: none"> • Formula time will not advance until water level and set point 2 are attained. • Heater (Y21) will not energize until low level is reached. • Check LED input indicator lights corresponding to low level (X5) and set point 2 (X10). • X5 and X10 should be ON <u>IF</u> water level and set point 2 were attained. Formula time should advance and Y36 should be ON. • If X5 is OFF, check water level switch. • If X10 is OFF, check temperature gauge and probe.

TABLE 6-2
PLC TROUBLESHOOTING GUIDE-CONT.

SYMPTOM	CORRECTIVE ACTION
8. (CONT.) TIME WHILE HEATING SWITCH ON	<ul style="list-style-type: none"> • Formula time will not advance until water level is attained. • If bath temperature is below set point 2, time while heating switch must be ON for formula to advance while heating. • Check LED indicator lights corresponding to low level (X5) and time while heating switch (X13). • X5 should be ON if water level is attained and X13 should be ON. Formula time should advance and (Y36) should be ON. • If X5 is OFF, check water level switch. • If X13 is OFF, check time while heating switch.
9. MACHINE WILL NOT EXTRACT LOW EXTRACT	<ul style="list-style-type: none"> • Check LED input indicator light corresponding to safety level (X7) and LED output light corresponding to low extract (Y3). • X7 should be ON indicating the water level is below a preset safety level (normally less than 4") and Y3 should be ON indicating the low extract contactor is energized. • Verify corresponding voltage. • If X7 is OFF and machine is empty, pressure bowl may be clogged or water level switch may be broken or out of adjustment. • If Y3 is ON check motor contactor, overloads, motor thermoguards, etc. • Check clutch releases.
HIGH EXTRACT	<ul style="list-style-type: none"> • Check LED output indicator light corresponding to high extract (Y2). • Y2 should be ON indicating high extract contactor is energized. • Verify corresponding voltage. • If Y2 is ON, check contactor, overloads, motor thermoguards, etc.

NOTE

If extract motors do not start or trip out, it is very likely due to a tripped heater coil due to excessive current drawn by the motor. This condition **WILL NOT** interrupt the timing of the formula. Cause of overload condition must be determined and corrected to eliminate tripping of contactor.

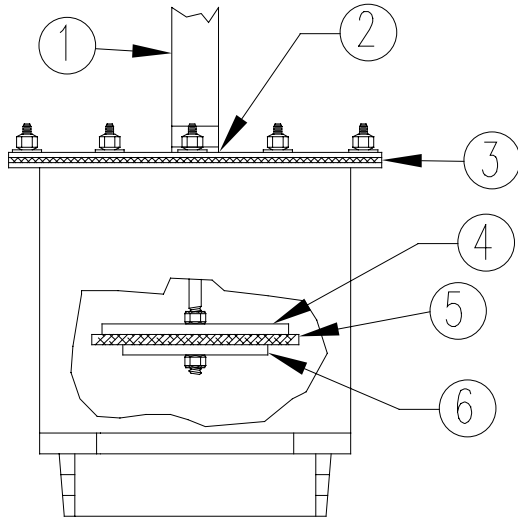
TABLE 6-2
PLC TROUBLESHOOTING GUIDE-CONT.

SYMPTOM	CORRECTIVE ACTION
10. EXTRACT MOTOR CYCLES ON AND OFF INTERMITTENTLY.	<ul style="list-style-type: none"> • Check LED input indicator light corresponding to water safety level (Y7). • X7 must remain ON during extract. • If LED input light corresponding to X7 is cycling ON and OFF during extract, the set screw in the water level switch is loose and has backed out too far causing the switch to cycle under vibration. Reset the screw.
11. FORMULA IS INTERRUPTED SIMULTANEOUSLY WITH A FIELD DEVICE BEING ENERGIZED AND EITHER SKIPS TO NEXT STEP OR RESETS TO BEGINNING OF FORMULA.	<ul style="list-style-type: none"> • Interruption is likely caused by an electrical short in a field device being energized by the corresponding PLC output. This situation will cause the PLC to shut down for a split second and result in either a reset to the next step in the formula or reset to the beginning of the formula.
<p style="text-align: center;">CAUTION</p> <p>The machine should be secured until corrective action is taken to repair the field device causing the problem, or the PLC output relay will be permanently damaged.</p>	
12. SOLID CHEMICALS DO NOT DISPENSE	<ul style="list-style-type: none"> • Check LED output indicator light corresponding to solid chemical dispensing system (Y26). • When the formula is started, Y26 should energize for 3, 5 and 7 seconds for formulas I, II and III respectively and detergent should dispense. • Bleach and sour receive signals to dispense from Y10 and Y11 respectively. • If chemicals do not dispense at appropriate formula times check Y26, Y10 and Y11 outputs. • Check chemical dispensing system.
13. MAIN DOOR PROBLEMS	
DOES NOT OPEN	<ul style="list-style-type: none"> • Check door-locking pin. Y20 should be OFF indicating pin is released. • Check if door pin is bent or stuck on opening in main door.
DOES NOT CLOSE PROPERLY	<ul style="list-style-type: none"> • Check and replace door gasket as necessary. • Adjust the locking nut on the door handle to provide the proper pressure when closed.

CHAPTER 7

ILLUSTRATIONS AND PARTS LISTS

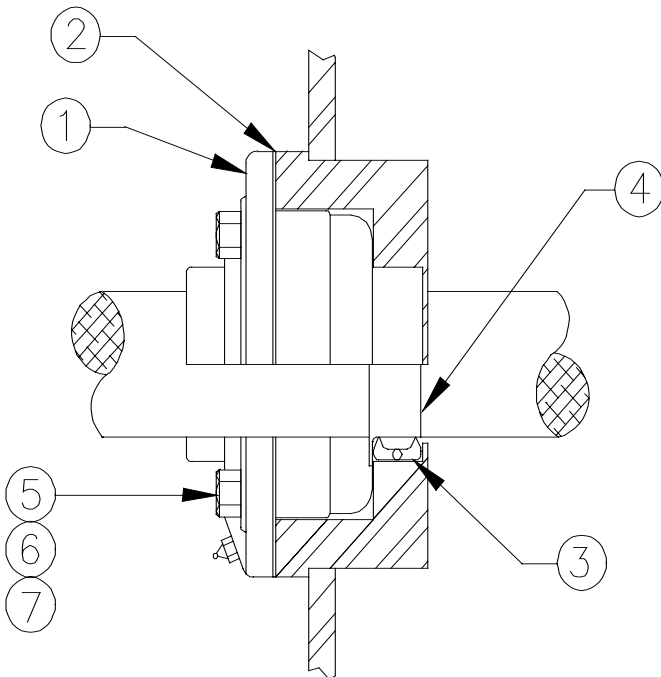
Figure 7-1
Drain Assembly



FOR ALL MODELS

<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Qty</u>
1	1130	Air Cylinder	1
2	1134	Air Cylinder Seal	1
3	1520-1117-1	Drain Cover Gasket	1
4	1520-1133	Top Plate	1
5	1520-1132	Gasket Seal	1
6	1520-1131	Bottom Plate	1

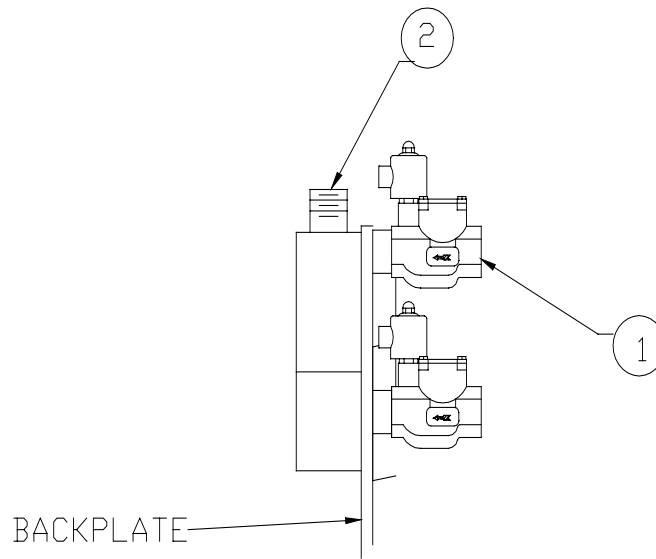
Figure 7-2
Bearing Assembly (2 Assemblies)



FOR ALL MODELS

<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Qty</u>
1	1520-1501	Bearing 3"	2
2	1520-1509	Bearing Gasket	2
3	1520-1515-1	Bearing Shaft Seal	4
4	S1520-1515-2	Speedi Sleeve	2
5	9756	Hex Head Bolt	8
6	1502	Bearing Key	2
7	9724	Flat Head Screw	2

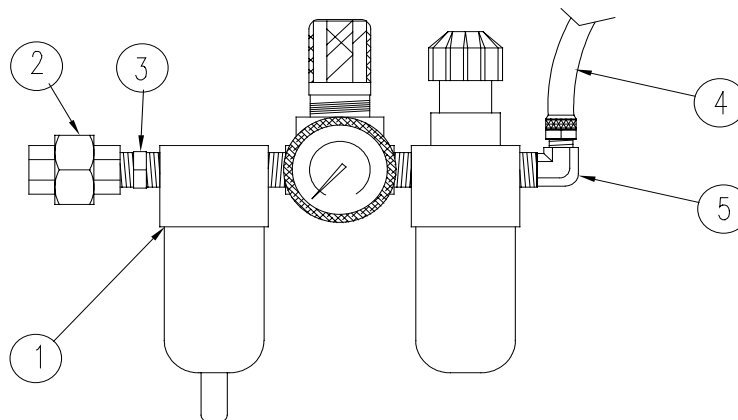
Figure 7-3
Water Inlets (Hot & Cold) and Salt Water Inlet



FOR ALL MODELS

<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Qty</u>
1	1234-3315	Main Water Valve 2"	2
2		Salt Water Intake 2"	1

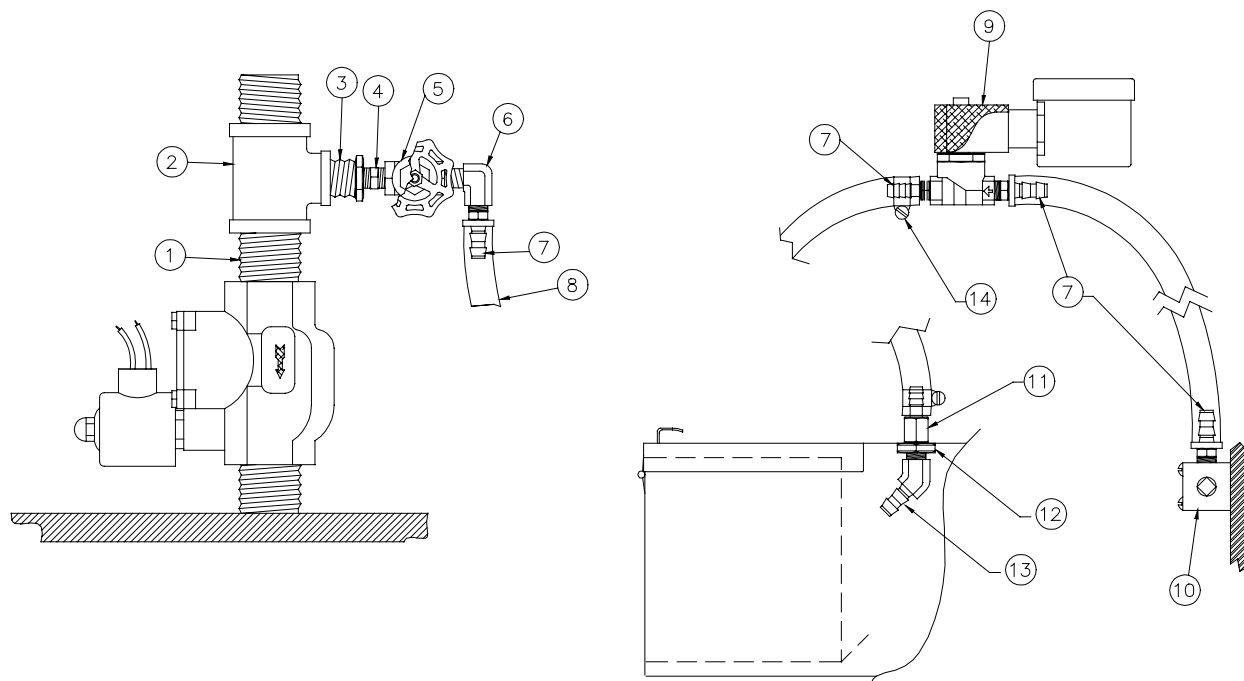
Figure 7-4
Air Inlet Assembly (FRL)



FOR ALL MODELS

<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Qty</u>
1	7121	F-R-L Unit	1
2	7024	Union 1/4" NPT	1
3	7014	Nipple 1/4" NPT	1
4	7012	Tubing	as required
5	7001	Elbow Air Fitting	1

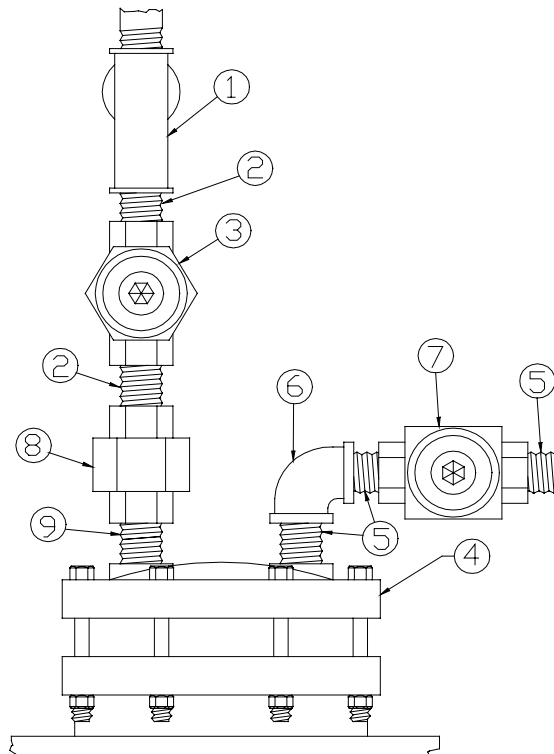
Figure 7-5
Automatic Supply System



FOR ALL MODELS

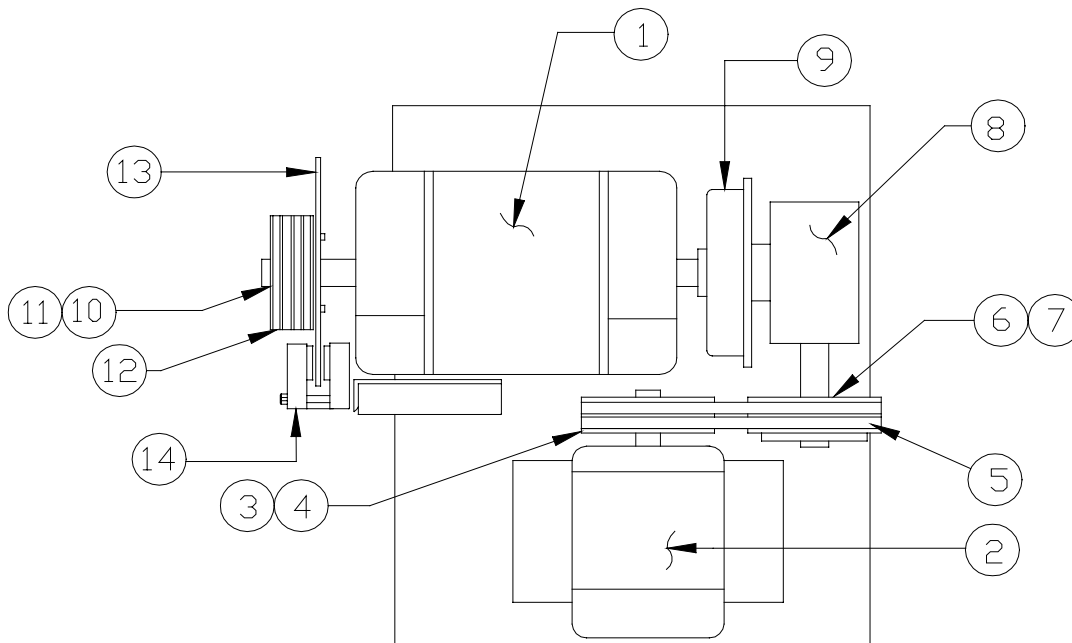
<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Qty</u>
1	1234-3311-1	Nipple 2" NPT	1
2	1234-3313	Tee 2" NPT	1
3	3271	Reducer 3/4" x 1/4"	1
4	7014	Hex Nipple 1/4" NPT	1
5	7164	Gate Valve 1/4" NPT	1
6	7003	Elbow 1/4" NPT	1
7	3193	Hose Fitting	8
8	3194	Hose 3/8" ID	10 ft
9	3235	Water Valve 1/4" NPT	2
10	3008	Water Manifold	1
11	3196	Hose Fitting 1/4" NPT	2
12	3591	Lock Nut	2
13	3178	Hose Fitting 1/4" NPT	2
14	3347	Hose Clamp	10

Figure 7-6
Indirect Steam Heating (Type I machines)



<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Qty</u>
1	3429	Strainer 1-1/4" NPT	1
2	610-3311-1	Nipple, Close	2
3	3428	Steam Valve	1
4	1520-3430	Tank Heater	1
5	3036-1	Nipple – SS 3/4" NPT	2
6	3035	Elbow – SS 3/4" NPT	1
7	3436	Steam Trap 3/4" NPT	1
8	610-3317	Union	1
9	610-3311	Nipple, Close	1

Figure 7-7
Motor Assembly with Brake



<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Qty</u>
1	5300-6B-20M	Extract Motor (2.5/2.5 h.p.)	1
2	5400-1B-1520	Wash Motor	2
3	5410-1520	Wash Sheave	1
4	5411-1520	Wash Sheave Bushing	1
5	5830-1234	Wash Belts	2
6	5510-1520	Gear Reducer Sheave	1
7	5511-1520	Gear Reducing Sheave Bushing 1	set
8	5500-1520	Gear Reducer	1
9	5600-1520	Air Drum Clutch	1
10	5310-1520	Extract Sheave	1
11	5311-1520	Extract Sheave Bushing 1	
12	5830-1520	Main Belts (not shown)	4
13	5731-1520	Brake Disc	1
14	5729	Brake	1

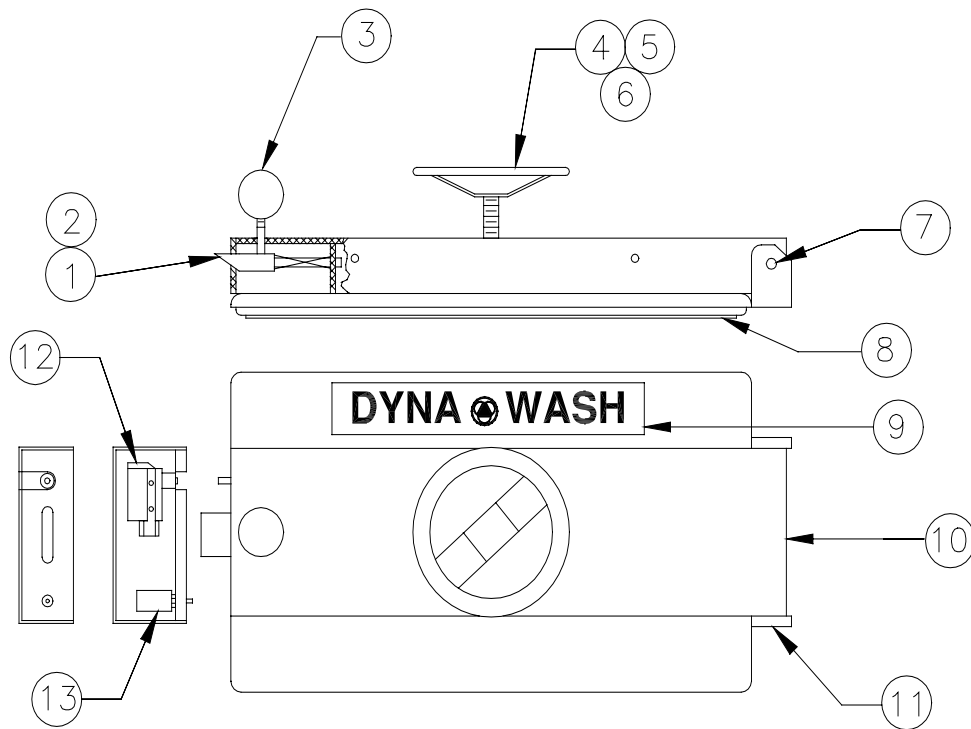
Wash Motor Brake Assembly (Not shown – Internal to Wash Motor)
Replacement Parts List

<u>Part No.</u>	<u>Description</u>	<u>Qty</u>
S1-055-331-00	Wash Motor Brake with Hub 230V/460V/3PH/60Hz	1

NOTE

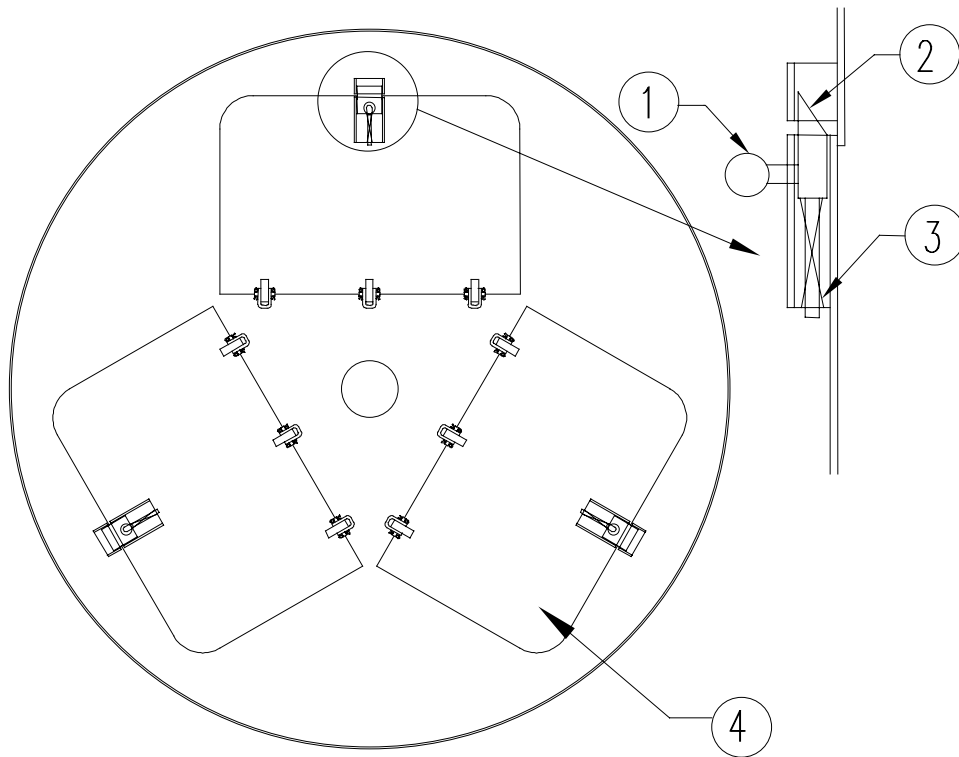
When ordering spare parts for Wash Motor Brake, specify Coil Kit number and voltage, and complete model and serial number off brake.

Figure 7-8
Main Door Assembly with Door Latch



<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Qty</u>
1	4007	Door Latch Bolt	1
2	2423	Spring	1
3	4009	Door Knob Assy.	1
4	4020	Door Wheel Handle	1
5	1234-4021	Door Handle Bolt	1
6	4024	Jam Nut	1
7	1234-4010	Door Hinge Rod1	
8	1234-4004	Door Gasket	6 ft
9	8401	DynaWash Decal	1
10	123-4002	Door Hinge	1
11	1520-4001	Door Plate	1
12	7230	Door Position Switch	1
13	7410	Door Lock Cylinder	1

Figure 7-9
Inner Door Assembly



FOR ALL MODELS

<u>Item</u>	<u>Part No.</u>	<u>Description</u>	<u>Qty</u>
1	2424	Knob Handle	3
2	2421	Bolt	3
3	2423	Spring	3
4	1520-2400	Inner Door Assembly	3

Inner Door Replacement Parts List (Not shown)

<u>Part No.</u>	<u>Description</u>	<u>Qty</u>
2414	Inner Door Hinge Rod	9
9595	Cotter Pin	18

Figure 7-10
Motor Controls & Wiring

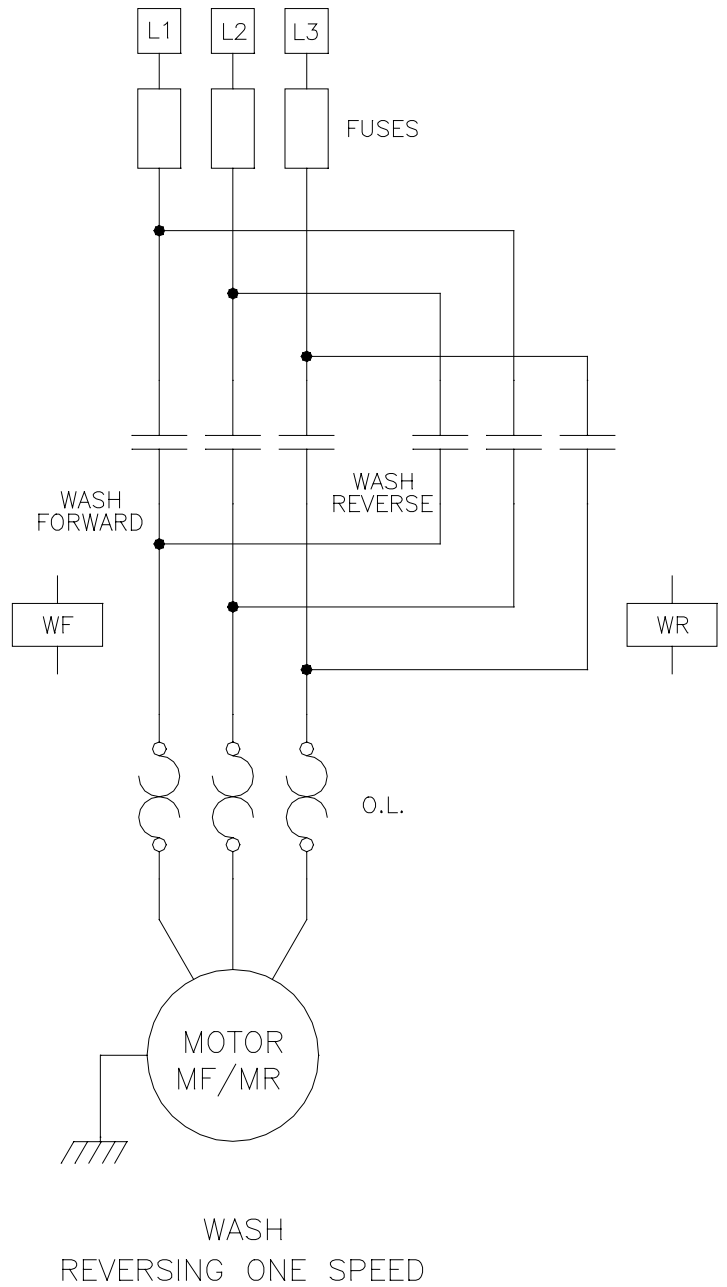
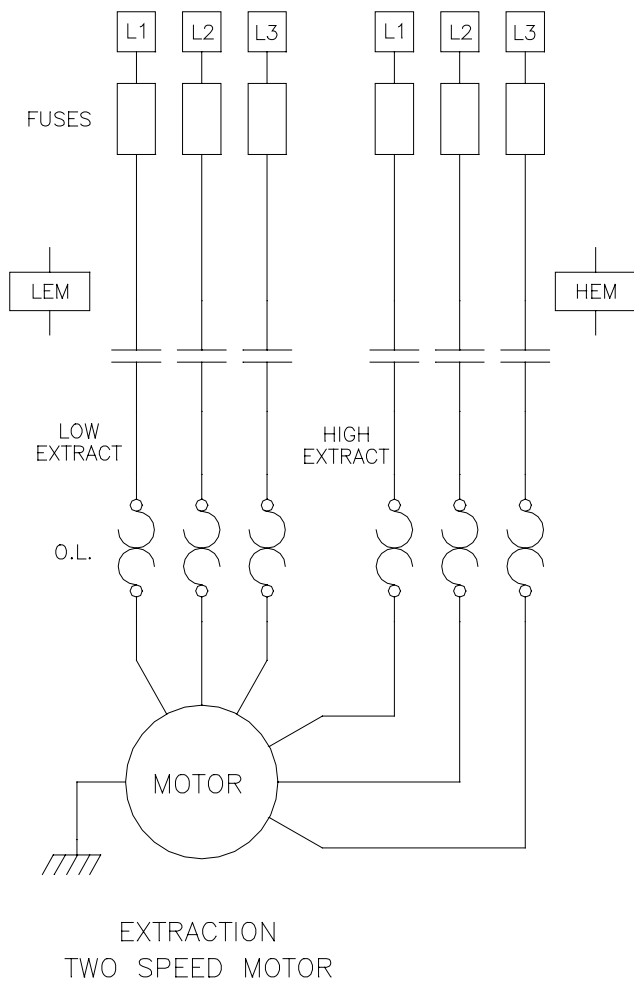


Figure 7-11
Extract Motor Connection

Two (2) Speed-Two (2) Windings Single Volts.

After the motor is shut down due to overheating, it cools very slowly and sometimes is required for the thermostat to cool sufficiently to reset. The resetting is automatic after the motor has been cooled about 77°F (@ 25°C) but it is impossible to reset the motor until the thermostat has reset.

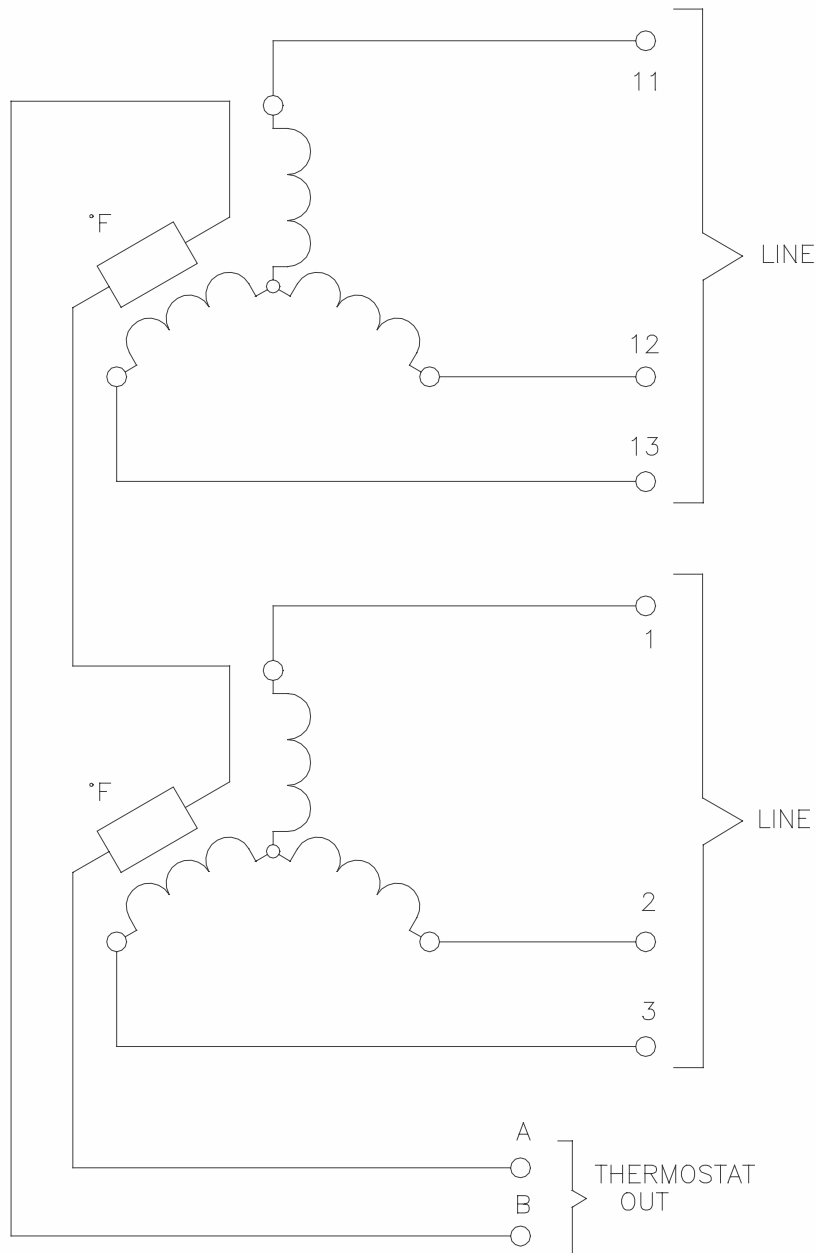
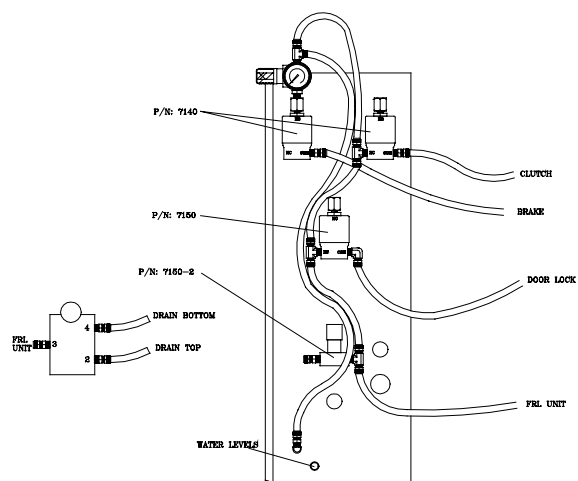
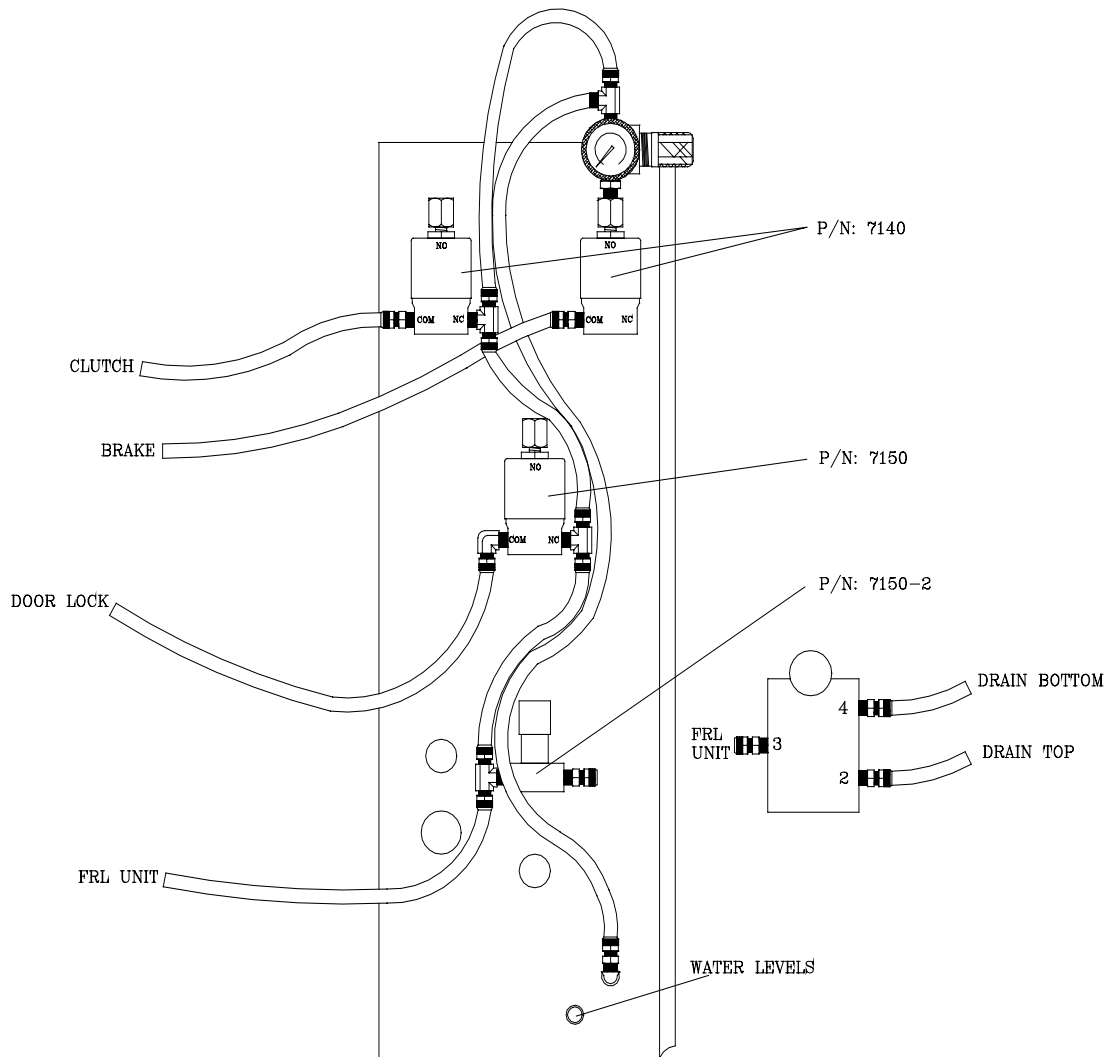
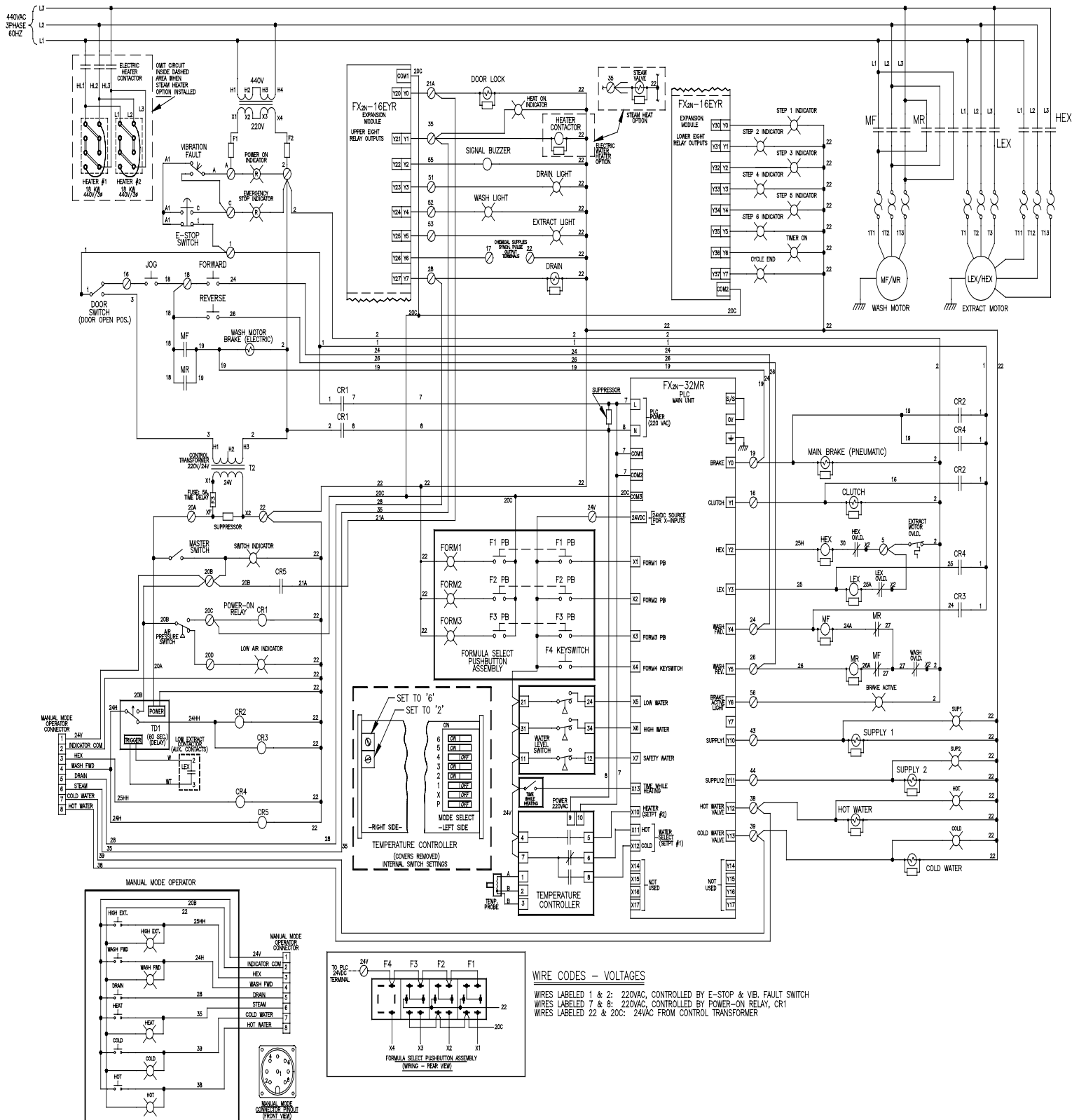


Figure 7-12
Pneumatic Assembly



Models featuring the Electrical Right ("ER") option have the pneumatic assembly diagrammed as illustrated to the left. Parts listing is same on both models.

Figure 7-13
Electrical Schematic (Rev 4, 11/08/00)



APPENDIX 1 **TEST DATA RECORDING SHEET**

Model No.: _____ Serial No.: _____

1-1 AUTOMATIC OPERATION

<u>STEP</u>	<u>EXPECTED RESULT</u>	<u>ACCOMPLISHED</u>	
		Satisfactory	Unsatisfactory
a.	Set-up procedure complete.	<input type="checkbox"/>	<input type="checkbox"/>
b.	Power ON light, if present, is illuminated.	<input type="checkbox"/>	<input type="checkbox"/>
	Emergency stop light is illuminated	<input type="checkbox"/>	<input type="checkbox"/>
c.	Cylinder does not rotate unless both JOG and FWD or REV buttons are depressed.	<input type="checkbox"/>	<input type="checkbox"/>
	Cylinder stops immediately (does not coast) upon release of either JOG or directional button.	<input type="checkbox"/>	<input type="checkbox"/>
	Cylinder rotates clockwise in FWD mode.	<input type="checkbox"/>	<input type="checkbox"/>
	Cylinder rotates counter-clockwise in REV mode.	<input type="checkbox"/>	<input type="checkbox"/>
d.	Machine does not start with shell door open.	<input type="checkbox"/>	<input type="checkbox"/>
	Machine starts when shell door is closed.	<input type="checkbox"/>	<input type="checkbox"/>
	Machine stops when E-stop button is depressed.	<input type="checkbox"/>	<input type="checkbox"/>
e.	Power ON light, if present, is illuminated.	<input type="checkbox"/>	<input type="checkbox"/>
	Brake light is illuminated.	<input type="checkbox"/>	<input type="checkbox"/>
	Drain light is illuminated.	<input type="checkbox"/>	<input type="checkbox"/>
	Temperature gauge is energized.	<input type="checkbox"/>	<input type="checkbox"/>
f.	Low air light is illuminated when air pressure is reduced below 50 PSI.	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX 1
TEST DATA RECORDING SHEET (CONT.)

<u>STEP</u>	<u>EXPECTED RESULT</u>	<u>ACCOMPLISHED</u>	
		Satisfactory	Unsatisfactory
	Machine does not start with air pressure below 50 psi.	<input type="checkbox"/>	<input type="checkbox"/>
g.	Low water level approximately 4"/8".	<input type="checkbox"/>	<input type="checkbox"/>
	High water level approximately 9".	<input type="checkbox"/>	<input type="checkbox"/>
h.	PLC LED indicator light corresponding to X7 does not go on until the water level drops to a minimum of 2" below the low water level.	<input type="checkbox"/>	<input type="checkbox"/>
i.	Temperature Set Point 2 (SP + AL) set at +/- 20 °F above actual bath temperature. (Note: Adjust Set Point 2 to 130 °F after test).	<input type="checkbox"/>	<input type="checkbox"/>
	Time while heating switch set to OFF.	<input type="checkbox"/>	<input type="checkbox"/>
j.	Formula 1 push button activates formula.	<input type="checkbox"/>	<input type="checkbox"/>
	Drain valve closes properly.	<input type="checkbox"/>	<input type="checkbox"/>
	Hot water valve opens properly.	<input type="checkbox"/>	<input type="checkbox"/>
	Air brake releases and wash motor and clutch engage properly.	<input type="checkbox"/>	<input type="checkbox"/>
	Solid chemical system output (Y26) energizes for 3 seconds after formula 1 push button is engaged.	<input type="checkbox"/>	<input type="checkbox"/>
k.	Booster heater energizes.	<input type="checkbox"/>	<input type="checkbox"/>
l.	Formula step time 1 advances.	<input type="checkbox"/>	<input type="checkbox"/>
	Heater remains energized.	<input type="checkbox"/>	<input type="checkbox"/>
m.	Booster heater de-energizes after Set Point 2 is attained.	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX 1
TEST DATA RECORDING SHEET (CONT.)

<u>STEP</u>	<u>EXPECTED RESULT</u>	<u>ACCOMPLISHED</u>	
		Satisfactory	Unsatisfactory
n.	Formula 1 Operational Test		
	Indicator lights illuminate during the appropriate formula step/time:		
	POWER ON	<input type="checkbox"/>	<input type="checkbox"/>
	EMERGENCY STOP	<input type="checkbox"/>	<input type="checkbox"/>
	LOW AIR	<input type="checkbox"/>	<input type="checkbox"/>
	WASH	<input type="checkbox"/>	<input type="checkbox"/>
	EXTRACT	<input type="checkbox"/>	<input type="checkbox"/>
	BRAKE	<input type="checkbox"/>	<input type="checkbox"/>
	HOT WATER	<input type="checkbox"/>	<input type="checkbox"/>
	COLD WATER	<input type="checkbox"/>	<input type="checkbox"/>
	HEATER	<input type="checkbox"/>	<input type="checkbox"/>
	DRAIN	<input type="checkbox"/>	<input type="checkbox"/>
	SUPPLY 1	<input type="checkbox"/>	<input type="checkbox"/>
	SUPPLY 2	<input type="checkbox"/>	<input type="checkbox"/>
	STEP INDICATOR	<input type="checkbox"/>	<input type="checkbox"/>
	TIMER ON	<input type="checkbox"/>	<input type="checkbox"/>
	CYCLE END	<input type="checkbox"/>	<input type="checkbox"/>
	Machine fills with hot water only during formula step 1.	<input type="checkbox"/>	<input type="checkbox"/>
	Machine fills to low level during formula steps 1, 2, 4 and 5.	<input type="checkbox"/>	<input type="checkbox"/>
	Formula step 1; supply injection valve #1 energizes and dispenses for 60 seconds after water level is attained.	<input type="checkbox"/>	<input type="checkbox"/>
	Drain valve opens and machine drains properly at the times specified by the formula.	<input type="checkbox"/>	<input type="checkbox"/>
	Clutch exhaust valve releases properly at start of extract cycles, formula steps 3 and 6.	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX 1
TEST DATA RECORDING SHEET (CONT.)

<u>STEP</u>	<u>EXPECTED RESULT</u>	<u>ACCOMPLISHED</u>	
		Satisfactory	Unsatisfactory
	Low speed extract engages cylinder in the clockwise direction.	<input type="checkbox"/>	<input type="checkbox"/>
	In formula step 3 low speed extract time is 60 seconds.	<input type="checkbox"/>	<input type="checkbox"/>
	In formula step 6 low speed extract time is 30 seconds followed by high speed extract time of 3 minutes and 30 seconds.	<input type="checkbox"/>	<input type="checkbox"/>
	High speed extract engages cylinder in the clockwise direction.	<input type="checkbox"/>	<input type="checkbox"/>
	Drain valve opens during extract steps.	<input type="checkbox"/>	<input type="checkbox"/>
	Air brake engages at the end of the extract cycles and stops cylinder within 60 seconds.	<input type="checkbox"/>	<input type="checkbox"/>
	Door pin engages at start of extract cycle and does not release until cylinder is completely stopped at end of extract.	<input type="checkbox"/>	<input type="checkbox"/>
	Controlled Temperature (Set Point 1) operation functions properly during steps 2, 4 and 5. (Demonstrated by hot/cold water valves alternately opening and closing as Set Point 1 is adjusted above and below the actual bath temperature during the filling process).	<input type="checkbox"/>	<input type="checkbox"/>
	Formula step 5; supply injection valve #2 energizes and dispenses for 60 seconds after water level is attained.	<input type="checkbox"/>	<input type="checkbox"/>
	Cycle end buzzer energizes.	<input type="checkbox"/>	<input type="checkbox"/>
	Cycle end light illuminates.	<input type="checkbox"/>	<input type="checkbox"/>

**APPENDIX 1
TEST DATA RECORDING SHEET (CONT.)**

<u>STEP</u>	<u>EXPECTED RESULT</u>	<u>ACCOMPLISHED</u>	
		Satisfactory	Unsatisfactory
o.	With Set Point 2 set below the actual bath temperature formula step 1 time advances after water level is attained.	<input type="checkbox"/>	<input type="checkbox"/>
	With Set Point 2 set above the actual bath temperature the heater energizes after water level is attained.	<input type="checkbox"/>	<input type="checkbox"/>
	With Set Point 2 set above the actual bath temperature and the time while heating switch OFF the formula step 1 time does not advance until Set Point 2 temperature is attained.	<input type="checkbox"/>	<input type="checkbox"/>
	With Set Point 2 set above the actual bath temperature and the time while heating switch ON the formula step 1 time advances after water level is attained.	<input type="checkbox"/>	<input type="checkbox"/>
	With Set Point 2 set above the actual bath temperature and the time while heating switch ON the heater deenergizes if Set Point 2 is attained prior to completion of formula step 1 time.	<input type="checkbox"/>	<input type="checkbox"/>
p.	Control circuit de-energizes.	<input type="checkbox"/>	<input type="checkbox"/>
	Emergency Stop light illuminated.	<input type="checkbox"/>	<input type="checkbox"/>

APPENDIX 1 **TEST DATA RECORDING SHEET**

1-2 MANUAL OPERATION

<u>STEP</u>	<u>EXPECTED RESULT</u>	<u>ACCOMPLISHED</u>	
		Satisfactory	Unsatisfactory
a.	Manual Operation Test		
	Hot water valve opens/closes.	<input type="checkbox"/>	<input type="checkbox"/>
	Cold water valve opens/closes.	<input type="checkbox"/>	<input type="checkbox"/>
	Heater energizes/de-energizes.	<input type="checkbox"/>	<input type="checkbox"/>
	Drain opens/closes.	<input type="checkbox"/>	<input type="checkbox"/>
	Wash motor energizes/de-energizes.	<input type="checkbox"/>	<input type="checkbox"/>
	Extract motor (low speed) energizes/de-energizes.	<input type="checkbox"/>	<input type="checkbox"/>
	Door pin engages during extract	<input type="checkbox"/>	<input type="checkbox"/>

LIST OF EFFECTIVE PAGES

Dates of original pages are:

Original . . . 0 . . . 1 MAY 1999

Change . . . 1 . . . 15 JAN 2001

Insert latest changed pages; dispose of superseded pages.

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TMCR : NDMS 940152-000

PURPOSE: To upgrade technical content, correct technical deficiencies and upgrade troubleshooting and repair procedures.

Equipment Alteration Numbers Incorporated : N/A

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CERTIFICATION STATEMENT

This is to certify that responsible NAVSEA activities have reviewed the above identified document for acquisition compliance, technical coverage, and printing quality. This form is for internal NAVSEA management use only, and does not imply contractual approval or acceptance of the technical manual by the Government, nor relieve the contractor of any responsibility for delivering the technical manual in accordance with the contract requirement.

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Record of Changes

Change No.	Date	Title or Brief Description	Signature of Validating Officer
1	01/15/01	<p>Cover, added change 1 under Revision 1 and changed date from 1 MAY 1999 to 15 Jan 2001</p> <p>Pg. 22, changed item 1 part number 6970 to 6971, changed item 2 part number 6005 to 6971-1 and item 2 qty from 2 to 1. Updated Electrical panel layout to new PLC configuration</p> <p>Pg. 24, 4-1.5, a, b, and e text updated</p> <p>Pg. 25, 4-1.5, r text updated</p> <p>Pg. 33, Figure 6-1, updated PLC Input/Output Diagram to new configuration</p> <p>Pg. 34, Table 6-1, X10 text updated</p> <p>Pg. 35, Table 6-1, Output expanders updated to current PLC configuration</p> <p>Page 44, Figure 7-6, item 4 changed from 3430-1520 to 1520-3430</p> <p>Page 45, Figure 7-7, item 1 changed from 5300-1520 to 5300-6B-20M and item 2 changed from 5400-1520 to 5400-1B-1520</p> <p>Page 46, Figure 7-8, item 5 changed from 1520-4021 to 1234-4021</p> <p>Page 51, Figure 7-13, electrical schematic updated to current PLC configuration</p>	

FOREWORD

Ship's training activities, supply points, depots, Naval Shipyards, and Supervisors of Shipbuilding are requested to arrange for the maximum practical use and evaluation of NAVSEA technical manuals. All errors, omissions, discrepancies, and suggestions for improvement to NAVSEA technical manuals shall be reported to the Commander, Port Hueneme Division, Naval Surface Warfare Center, Port Hueneme, CA 93043-4307 on NAVSEA Technical Manual Deficiency/Evaluation Report, NAVSEA Form 4160/1. To facilitate such reporting, two copies of NAVSEA Form 4160/1 are included at the end of each bound part of each technical manual. All feedback comments shall be thoroughly investigated and originators will be advised of action resulting therefrom. Extra copies of NAVSEA Form 4160/1 may be requisitioned from DDSP, 5450 Carlisle Pike, Bldg 05, Mechanicsburg, PA 17055-7089.

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